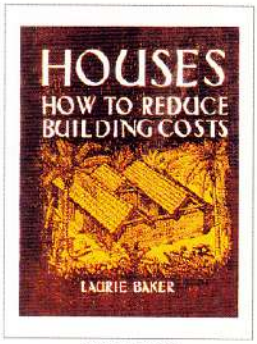
COST REDUCTION FOR PRIMARY SCHOOL BUILDINGS

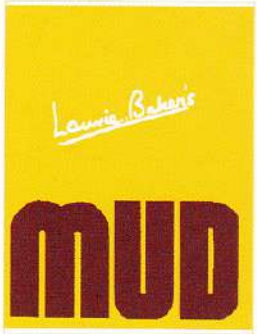
Laurie Baker

COSTFORD

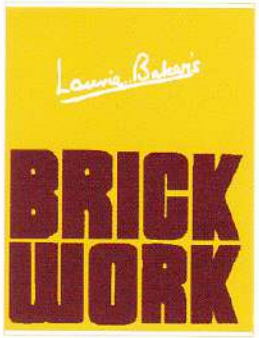
Other Titles in the Series



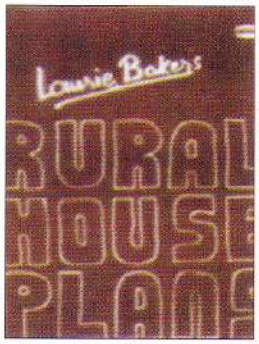
HOUSES
HOW TO REDUCE
BUILDING COSTS



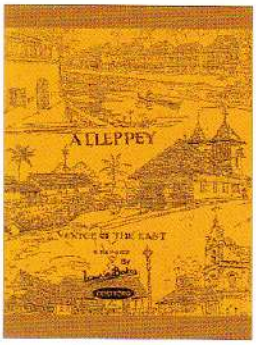
MUD



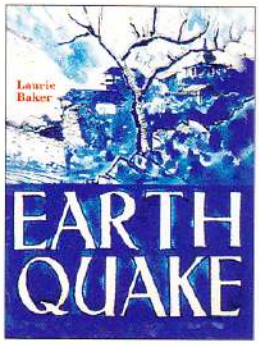
BRICK
WORK



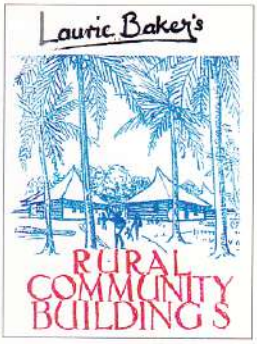
RURAL
HOUSE
PLANS



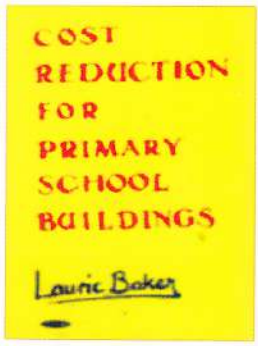
ALLEPPEY
VENICE
OF THE EAST



EARTH
QUAKE



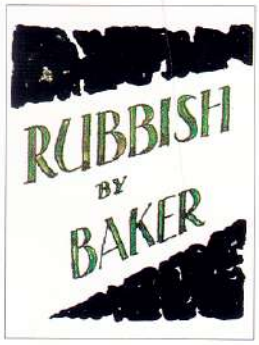
RURAL
COMMUNITY
BUILDINGS



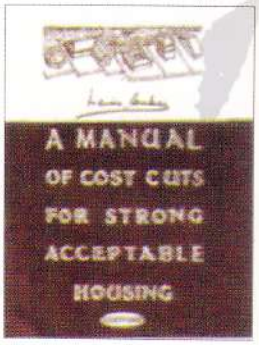
COST REDUCTION
FOR PRIMARY
SCHOOL BUILDINGS

HOUSES
HOW TO REDUCE
BUILDING COSTS

ARE
SLUMS
INEVITABLE



RUBBISH
BY
BAKER



A MANUAL OF COST CUTS
FOR STRONG
ACCEPTABLE HOUSING

COSTFORD
Centre of Science and Technology For Rural Development
Ayyanthole, Thrissur, Kerala, India, PIN-680 003
Phone: 91-487-2365 988, 2366 388.
Fax: 91-487-2366 388

COST REDUCTION FOR PRIMARY SCHOOL BUILDINGS

Laurie Baker

Published by

COSTFORD

Centre of Science and Technology
For Rural Development

COSTFORD

English

COST REDUCTION
FOR PRIMARY
SCHOOL BUILDINGS

Laurie Baker

First Edition
Published in 1997

Reprint - May 2014

Published by
Centre of Science and Technology For Rural Development

Ayyanthole, Thrissur, Kerala, India-680 003
Phone: 91-487-2365 988, 2366 388.
Fax: 91-487-2366 388

Cover & Illustrations
Laurie Baker

Price: ₹. 90/-

Printed at: MUDRA Sivakasi, Ph: 9447410514

COST REDUCTION FOR PRIMARY SCHOOL BUILDINGS

Laurie Baker

PRIMARY SCHOOLS

There can be no ONE plan nor ONE prototype plan which will be suitable for the whole of India. For example a primary school in India's state of Kerala will almost always need four teaching areas for a minimum of a hundred children. Teachers will also be available

Whereas in a recent visit to Garhwal in U.P. I saw that many small villages had less than 100 people and with climbing up & down narrow paths even several kilometers from each other, a shared primary school would have difficulty in getting 30 primary age children together. And so on. Perfectly obviously the physical requirements for a primary school will vary considerably all over the country — & very often in one State.

Similarly when we are considering the COST of establishing primary schools the available building materials & techniques will also vary very much from district to district Re-fabricated items may (questionable!) reduce costs where transport & availability of materials such as steel, cement, glass & even burnt brick — are locally available but in many remote or hill & mountain districts these items are not available. For example planners still do not seem to

be aware that SAND, for use in mortars, plaster and Reinforced Concrete work is NOT found in hill & mountain regions. Sand is mainly the product of disintegrating rocks & stone & is found at the foot of hills after being washed down by rain & swiftly flowing turbulent streams & rivers.

Concerning COST REDUCTION in building several very important factors must be kept in mind.

The FIRST point is that on no account must STRUCTURAL STABILITY be reduced or meddled with. This means that you must Not reduce quantities & quality & the correct proportion of mixes of materials in order to reduce cost. This does not mean that you may never deviate from the limitations of the Building Code, but it does mean that only tested and established alternatives should be used.

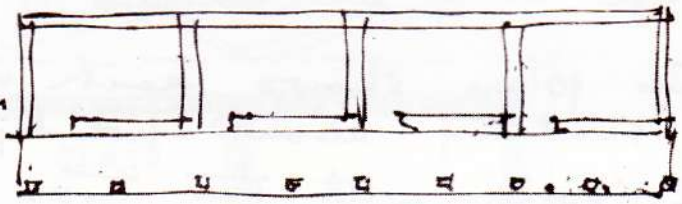
The SECOND point is that there are far more tried & tested (over centuries) traditional & indigenous 'in situ' materials to be found plentifully & inexpensively all over the country — & this means that some of them may well be available near our proposed building site & the use of these is likely to be a more reliable way of cost reduction, when compared with current orthodox "P. W. D" materials & systems.

or with many of the "advanced" prefabricated units, from wall & roofing panels to all the many forms of cement-plus-something blocks. Again, this does not mean that we should not use these items but only use them after comparing them with the established traditional local materials & taking into full account such items as transportation & availability of skilled workmen etc.

The THIRD point is to keep in mind the fact that the country is in short supply of ENERGY — ie fuel. Energy-intensive materials such as cement, steel, glass — (even burnt bricks!) must be used sparingly (there are more important uses for them than building) and low-energy or energy-free materials should be given preference.

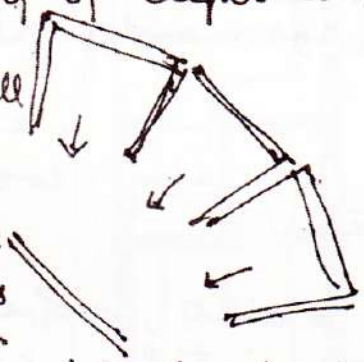
To me, there is one further FOURTH point. A very large part of a child's day is spent in school surroundings. These buildings & their environment should be as beautiful & friendly & inviting as possible. Square boxes, long straight lines, deadly dull repetition and so on are not an acceptable milieu for a young growing child.

Another especially important aspect of reducing the cost of primary school buildings is to give far more thought to their plan. The traditional row of square rooms opening off a long straight corridor or verandah is wasteful.



This circulation area can be designed so that it can be used profitably for other purposes as well as for a passageway.

I have also built a number of schools without doors & windows. In many areas, the old JALI wall is ideal for giving plenty of light and ventilation.



Very often the fourth wall of a class room is not a necessity & from experience we have learnt that one class functioning in an open sided room does not disturb adjoining classes. All classes can, when desired, turn towards the open wall & a form of common auditorium is available at no extra cost.

The following plans are tried and appreciated (by teachers & students) and are shown to illustrate these various unorthodox ideas.

This plan also has four rooms, a staff room & a Kitchen & toilets

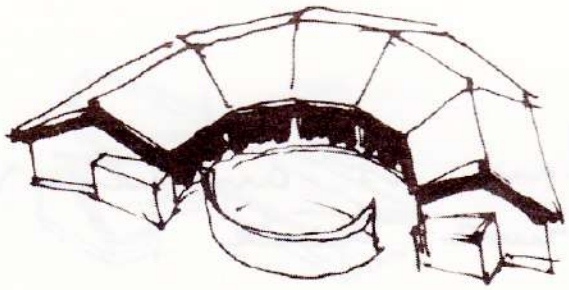
The class 'rooms' (or teaching areas) are radially placed so that the entire space within the outerwalls forms a sort of open auditorium

It may also be noted that these plans are very suitable for Schools where the teaching staff is not available for one teacher to each class.

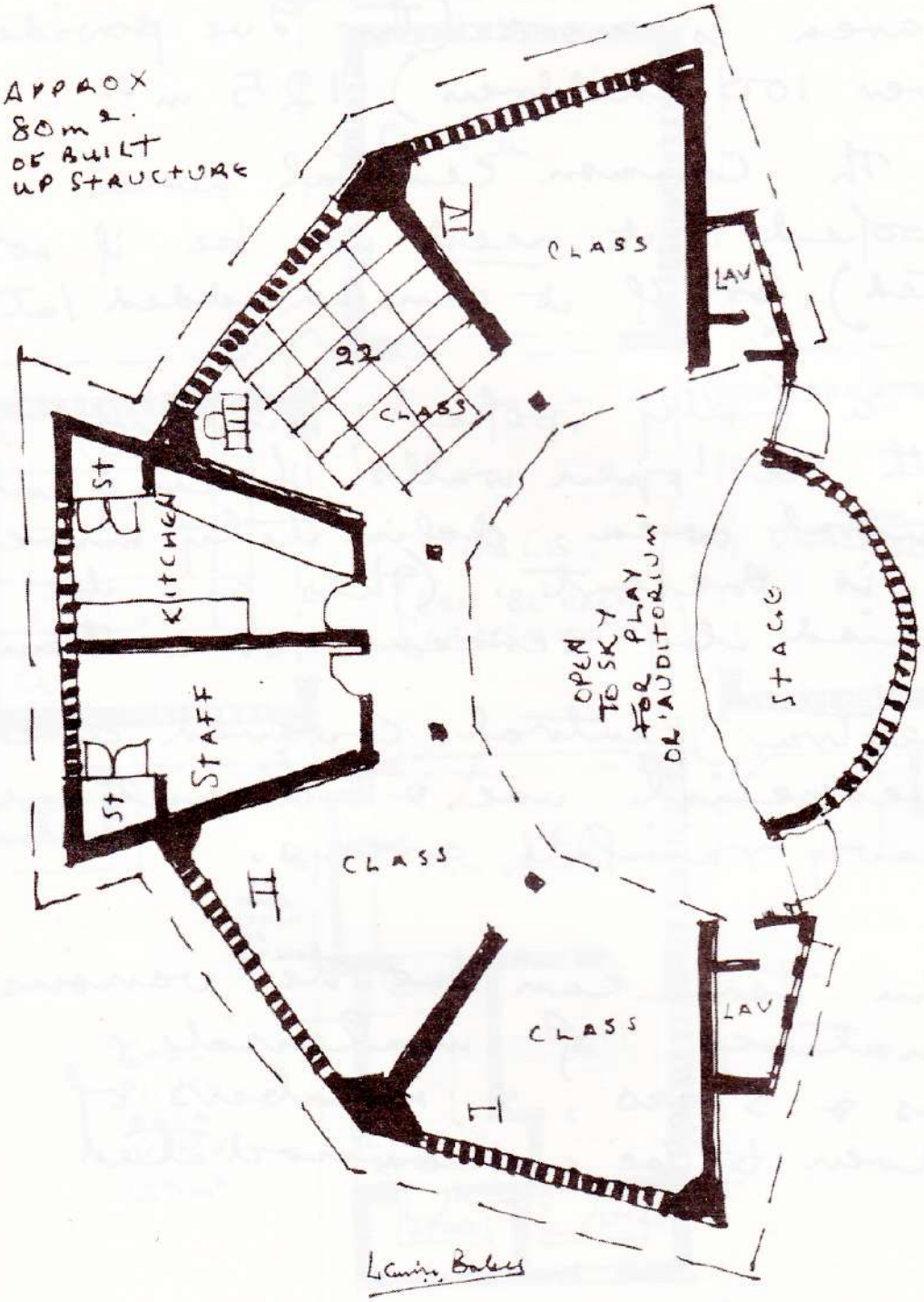
Again — actual ~~rooms~~ room sizes can be larger or varied. The plan shown can seat 20 or 22 in each room

The total roofed built area (not Counting the stage, yard & Toilets) is about 80 m^2

Altho jali walls are shown, if funds &/or circumstances require it; windows can be inserted, (tho it should be kept in mind that children can be destructive & broken window shutters are not uncommon. Such damage does not happen to jali walls.



plan



Lawrence Baker

This plan is another variation on the same theme!

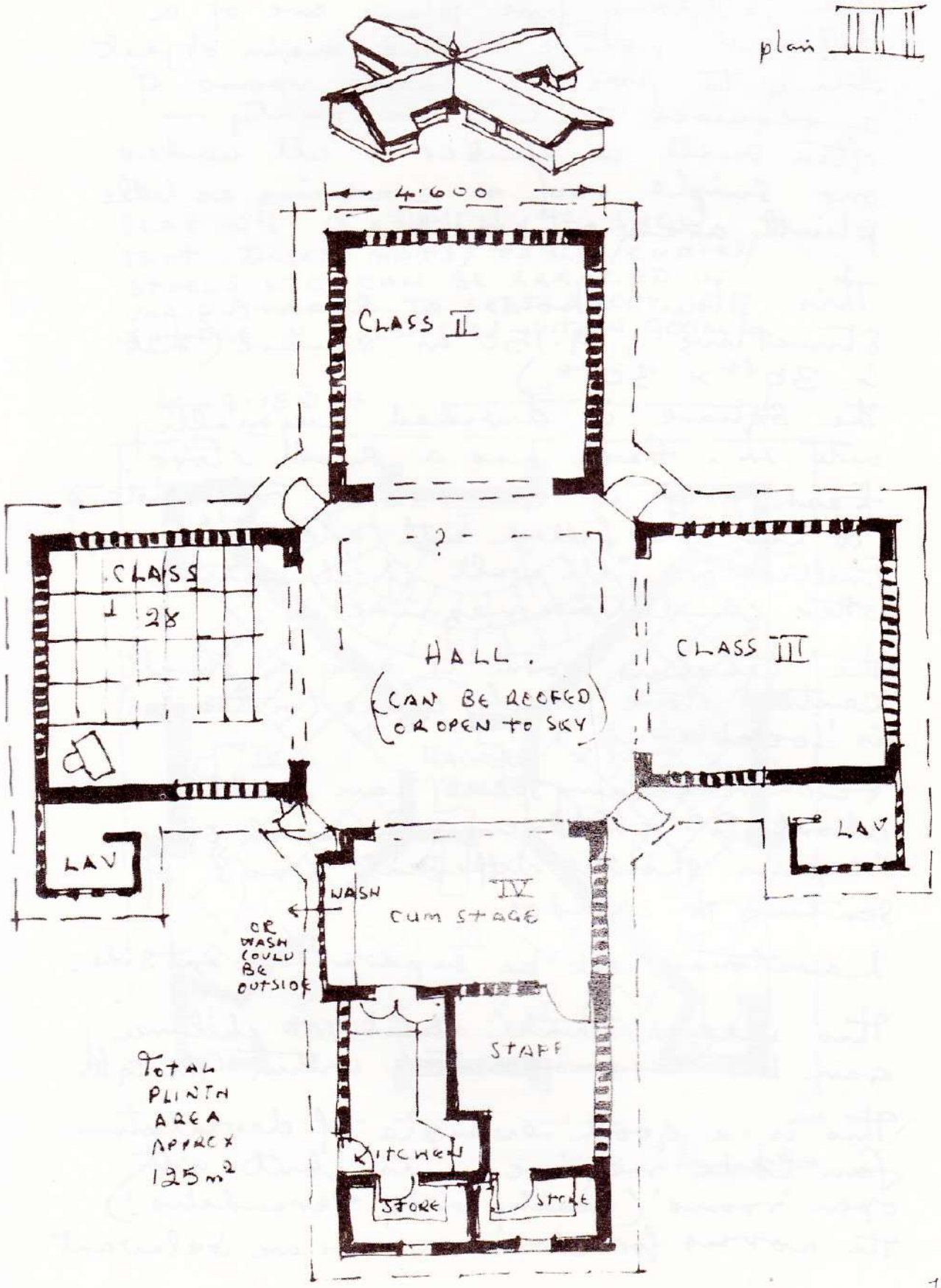
The area is more (than I've provided for over 100 children) 125 m2 and the common central area is roofed (it need not be if not wanted); (or if it can be added later)

With a fully roofed building, & with the 'open walls' facing into the central area, definitely more noise is present. (This can be remedied by screens or curtains)

The extra central covered area has especial use & advantage in heavy rainfall areas.

Again there can be the various alternatives of materials, areas & sizes, & numbers of children to be accommodated

plan III


4'600
CLASS II
?
CLASS I
28
HALL.
(CAN BE ROOFED OR OPEN TO SKY
CLASS III
LAV
LAV
WASH
IV
CUM STAGE
OR WASH COULD BE OUTSIDE
STAFF
KITCHEN
STORE
STORE
TOTAL PLINTH AREA APPROX 125 m²

The following five plans are of a different nature — The main object being to provide class rooms of a required seating capacity — often small in number & all under one simple roof & covering as little plinth area as possible.

This plan shows a square structure, 9.150 m square (that is 30 ft x 30 ft.)
The square is divided diagonally into 4. Each has a small store. Each room is open on the outer side (it can be filled with a 'grill', or trellis, or jali wall if climatic & other conditions require it.

The teachers room is only a small central store which alone (in this plan) is 'lockable-up'

Each teaching space can seat about 20 children. In each space the plan shows different ways of seating the children.

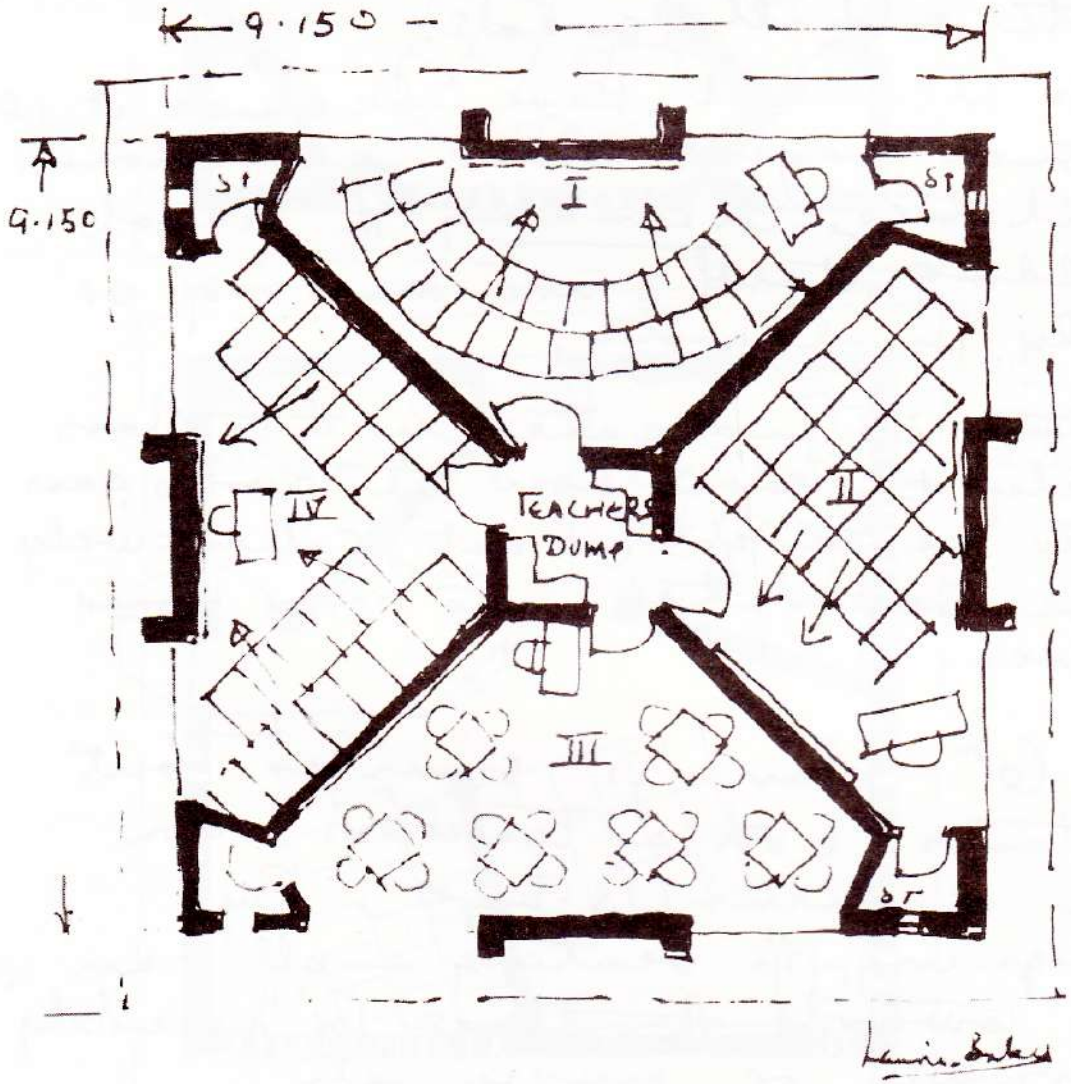
Lavatories will be seperate & outside.

This means that about 100 children can be accommodated within 900 sq ft.

This is a good example of deviation from Code requirements but with open 'rooms' (really only verandahs!) the norms for closed rooms are irrelevant

PLAN IV

SEATING IS SHOWN TO SHOW THAT DESKS/MATS/TABLES/CHAIRS/STOOLS ETC CAN BE ARRAGED IN VARIOUS WAYS TO SEAT ABOUT 100 CHILDRE IN 4 CLASSES WITHIN 900sq ft.



Lewis Baker

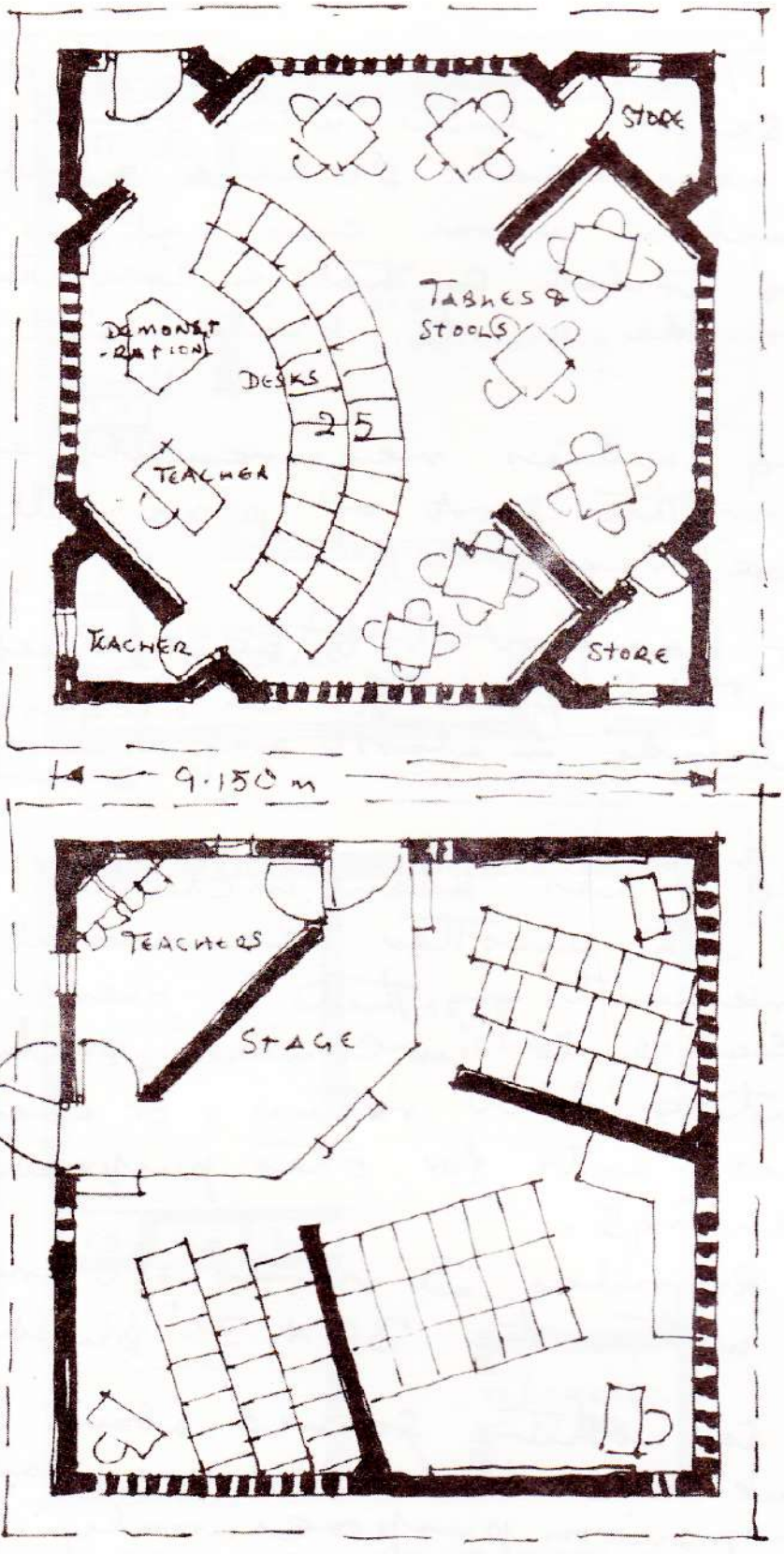
Plan 5 is similarly contained within a 30 foot square structure.

4 (or similar plans) have been used where only one teacher is available for dealing with a small number of children of different ages. This situation is not uncommon in remote & hill areas.

(4 is included here because it is in such regions where educational facilities, including the school building itself, are missing or totally inadequate.

Seating is indicated in the plan merely to show how the group can either be taught (or act) collectively or be separated into 3 or four classes.

The 6th plan is similar but contains both a teachers room and a mini 'stage'. By re-aligning the seating — all can face towards the stage for "assembly" or dramas or music etc.


Plan V
STOCK
TABLES & STOOLS
DEMONST-RATION
DESKS
25
TEACHER
TEACHER
STORE
9·150 m
Plan VI
TEACHERS
STAGE

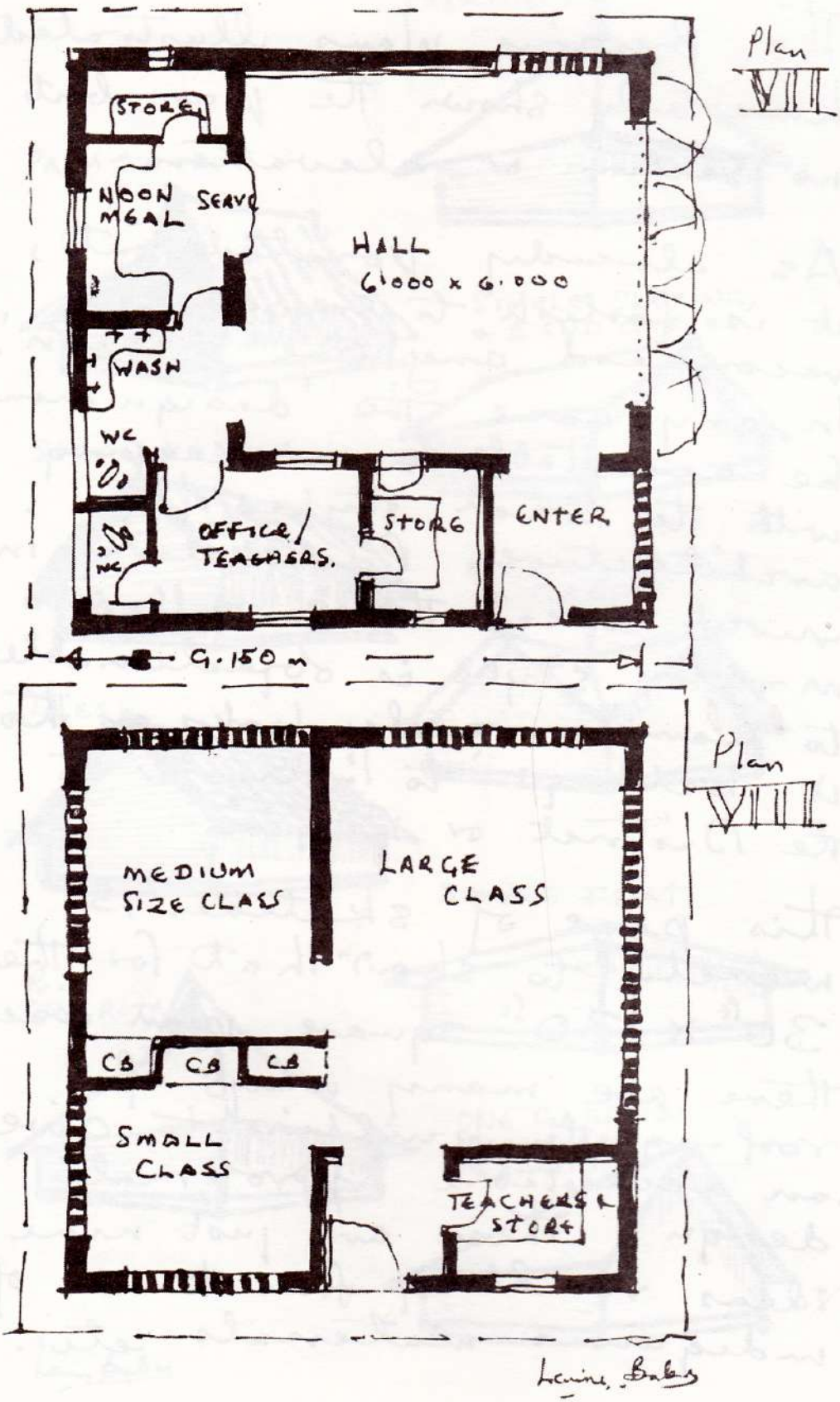
Plan 7 is again meant for a one room school but with facilities for a noon-meal scheme & even the teachers room can act as the room & toilet so that a lone teacher can reside in the building at night

Taking Indias requirements as a whole — this sort of plan will not often be required

tho it has proved to be a useful & practical plan for an 'Anganwadi' or 'Balwadi' in almost any area or region

Plan 8 has been included to deal with another occasional requirement — that is where attendance is irregular, or children drop out & don't return, or where the school acts for other purposes in the evenings.
So it provides 3 rooms of varying sizes within the 30' x 30' building

(There is nothing sacred about 30x30! The same area has been maintained for comparison purposes only.)

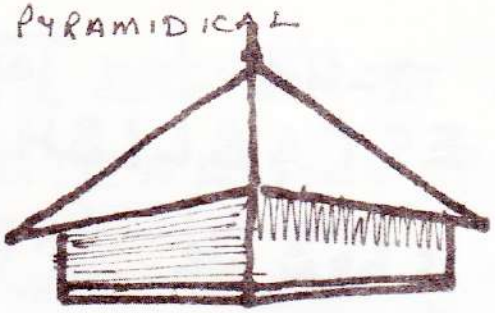

Plan VII
STORE
NOON MEAL SERVE
HALL
61000 x 61000
WASH
WC
WC
OFFICE / TEACHERS.
STORE
ENTER
61150 m
Plan VIII
MEDIUM SIZE CLASS
LARGE CLASS
CB
CB
CB
SMALL CLASS
TEACHERS STORE
Louise Bates

The previous plans illustrated have only shown the plan but no section or elevation.

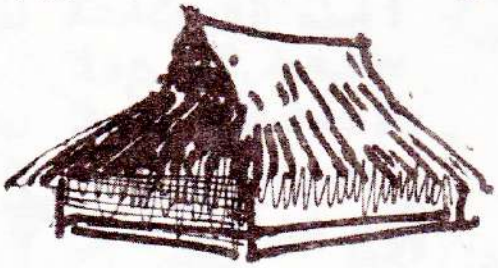
As already pointed out, it is foolish to suggest or recommend any one 'design'. In any case the 'design should be acceptable & in keeping with the local styles of architecture. Particularly in rural areas the so-called modern style is objectionable to many & rarely looks as tho it 'belongs' to India or to the District or Region.

This page of sketches is merely to show that for the 30ft x 30ft square plan used there are many ways of roofing the building to give an acceptable appropriate design. These are just nine ideas resulting from the use of indigenous materials etc.

PYRAMIDICAL

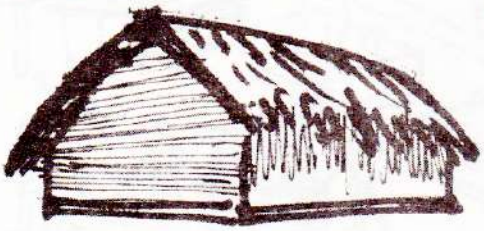


PALM THATCH

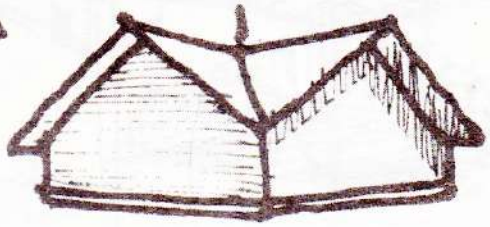


SIMPLE SLOPING + 2 END GABLES

STRAW THATCH

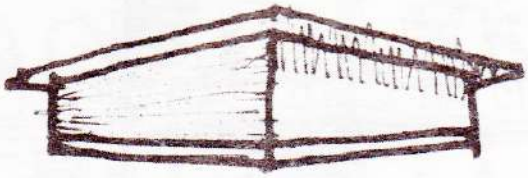


SLOPING WITH 4 GABLES

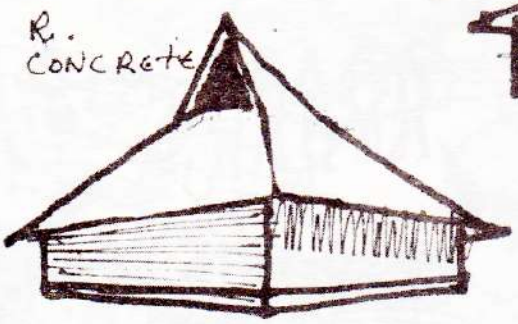


TILES

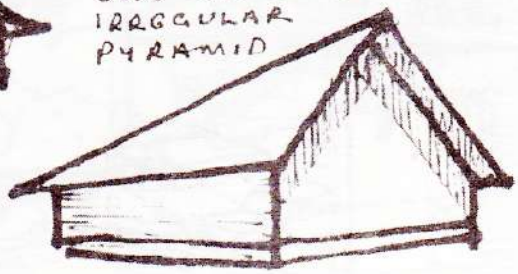
SIMPLE FLAT



R. CONCRETE



ONE GABLE & IRREGULAR PYRAMID

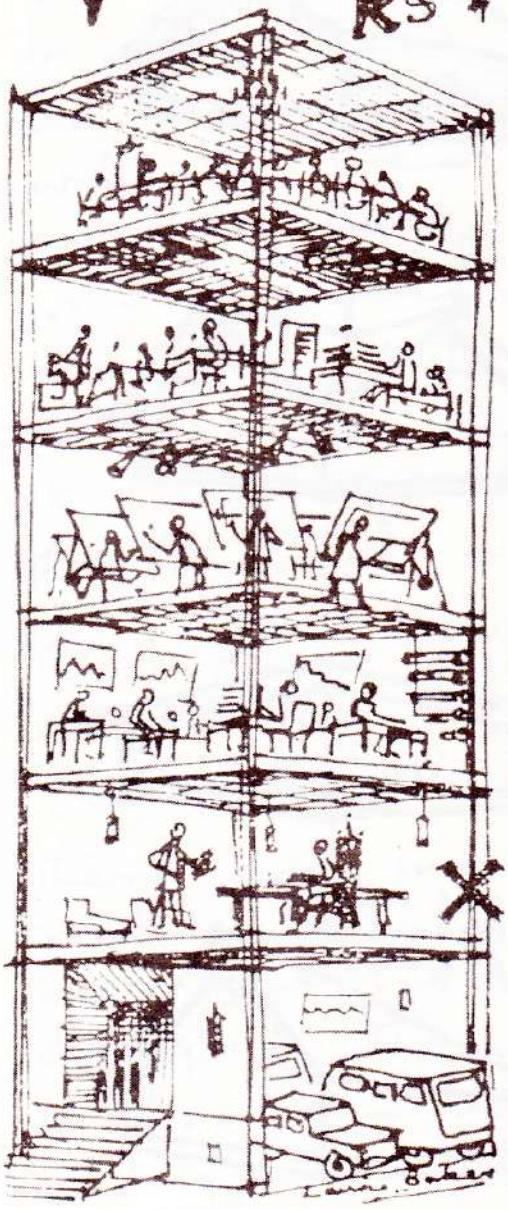


Laurie Baker

We waste far too much money on ESTABLISHMENTS !

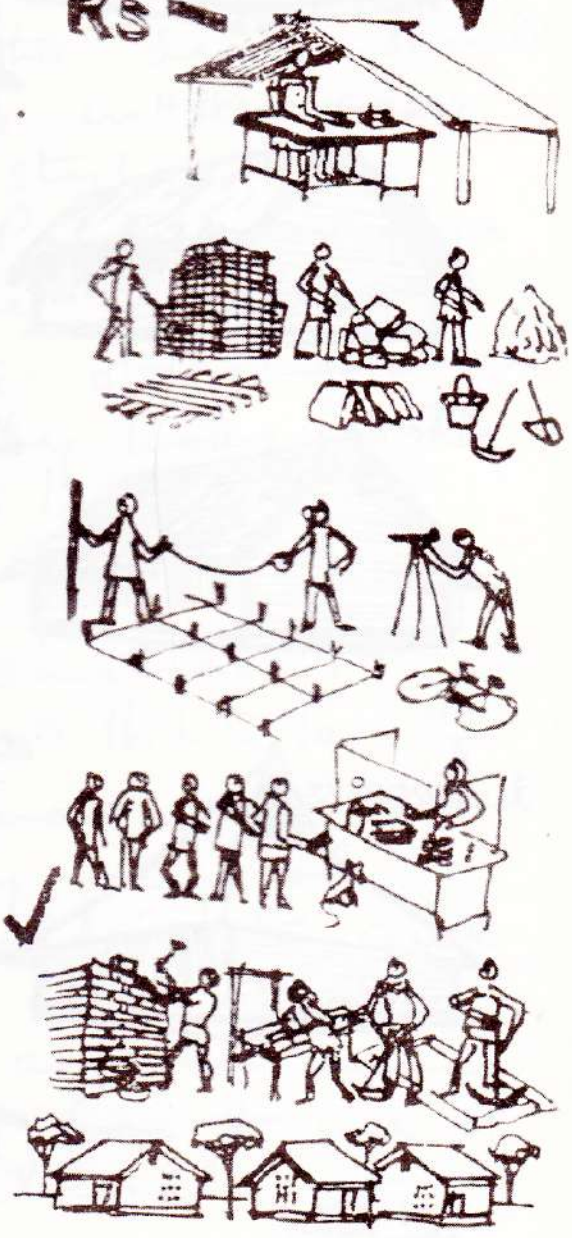
This is how we Spend our money

Rs +

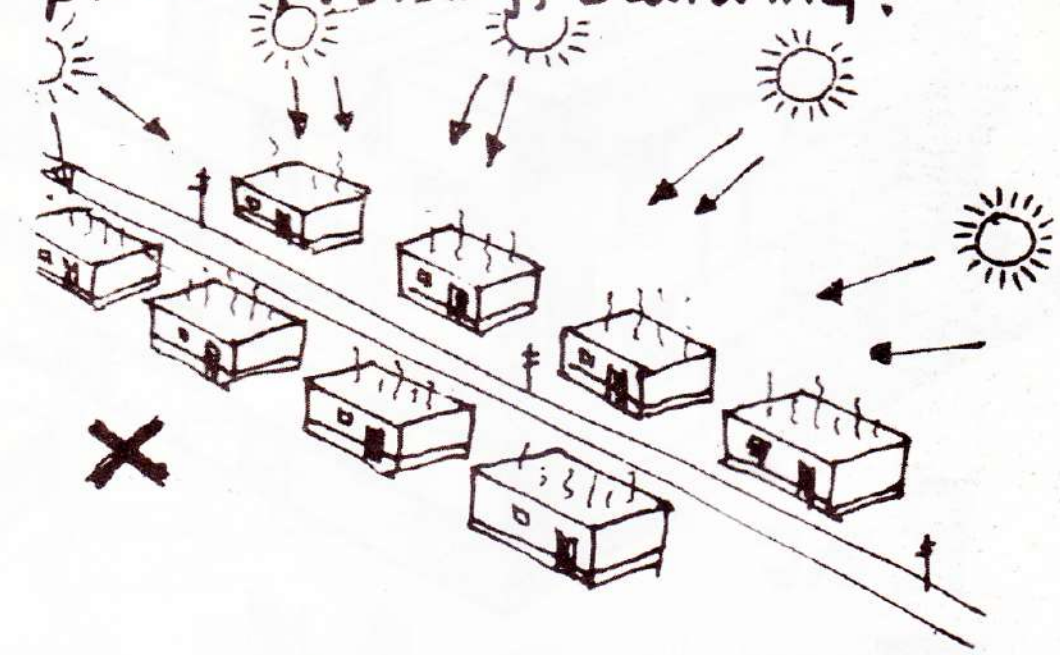


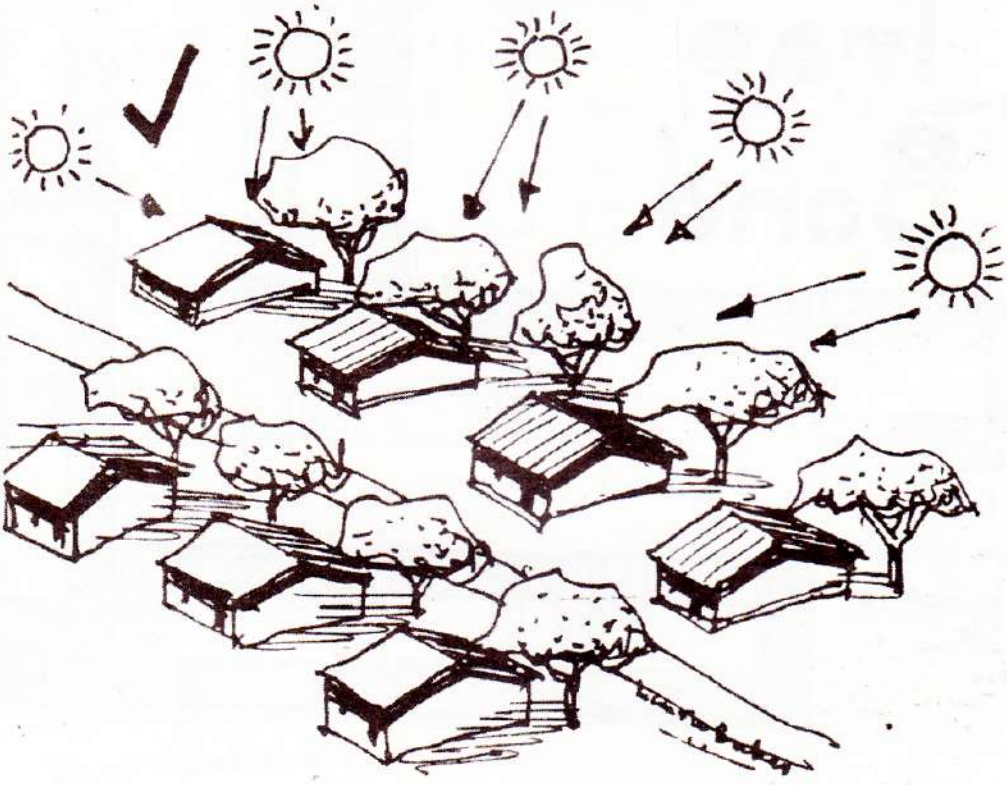
This is what we need to get schools put up for use.

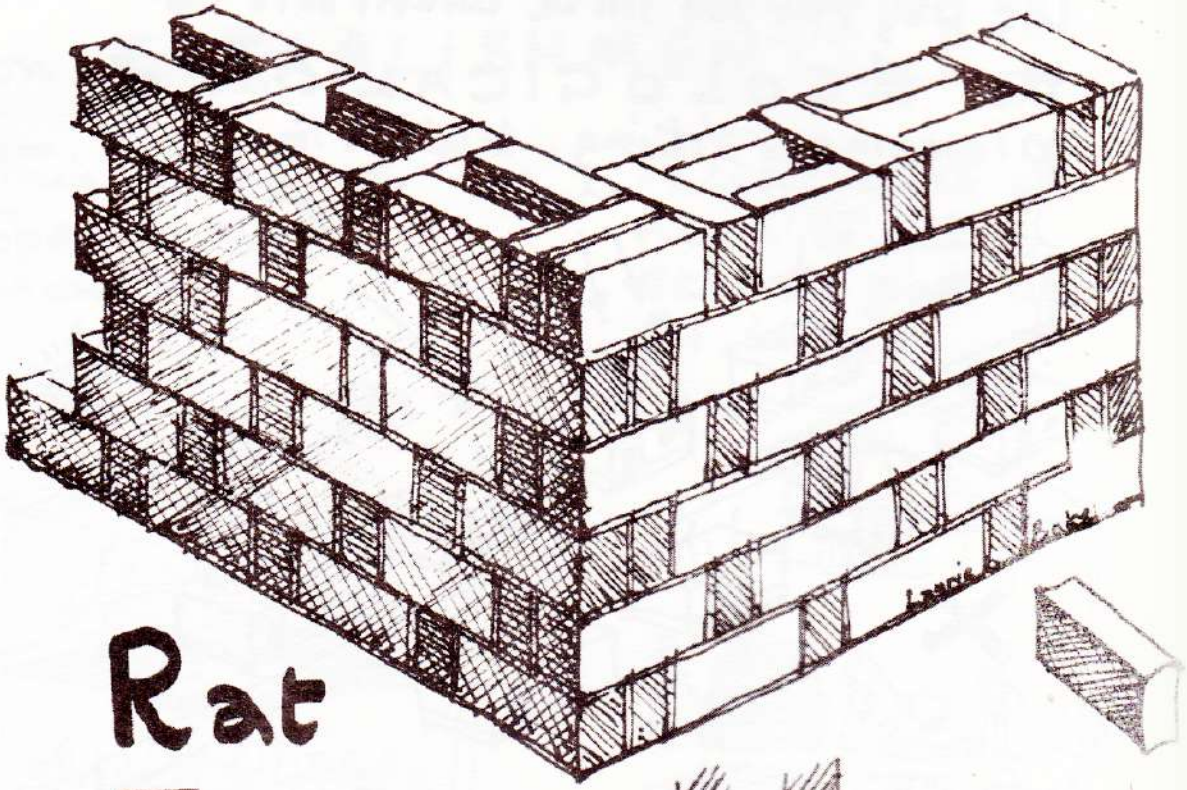
Rs –



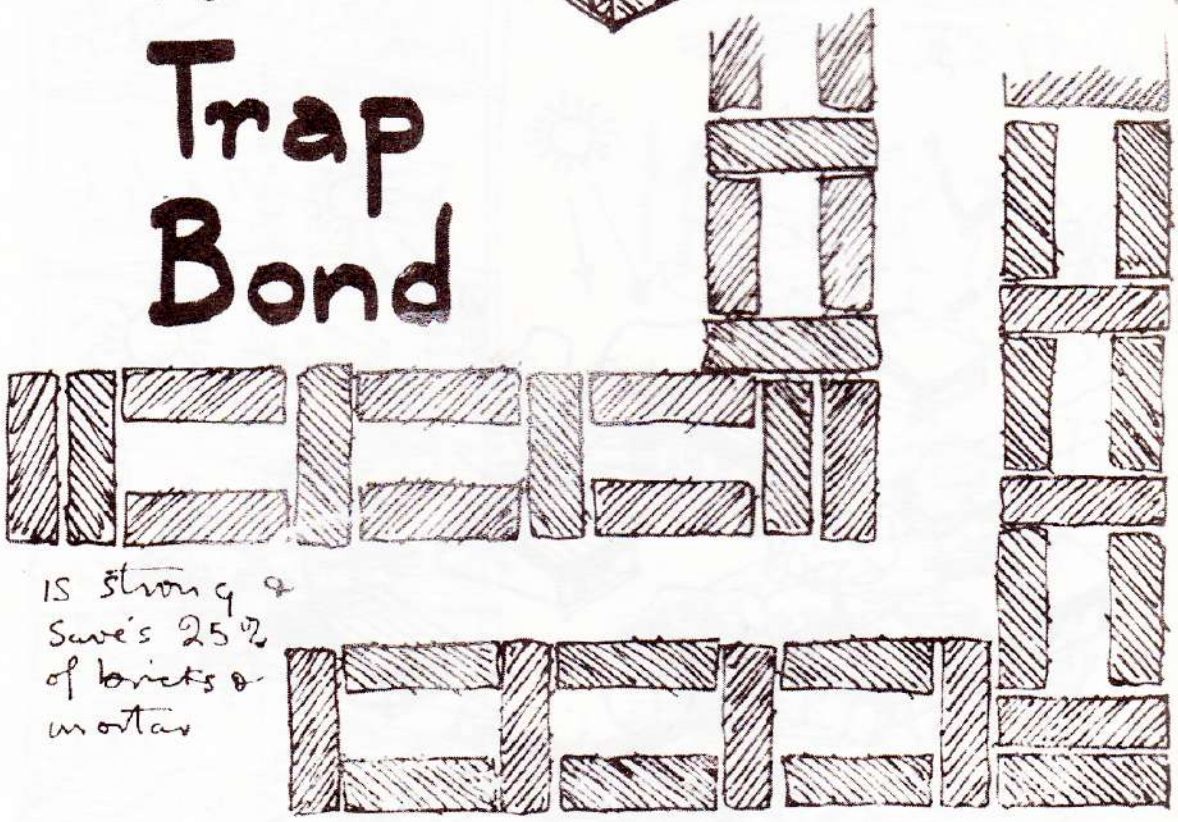
We pay far too little attention to the ECOLOGICAL side of planning, siting, building.







Rat Trap Bond



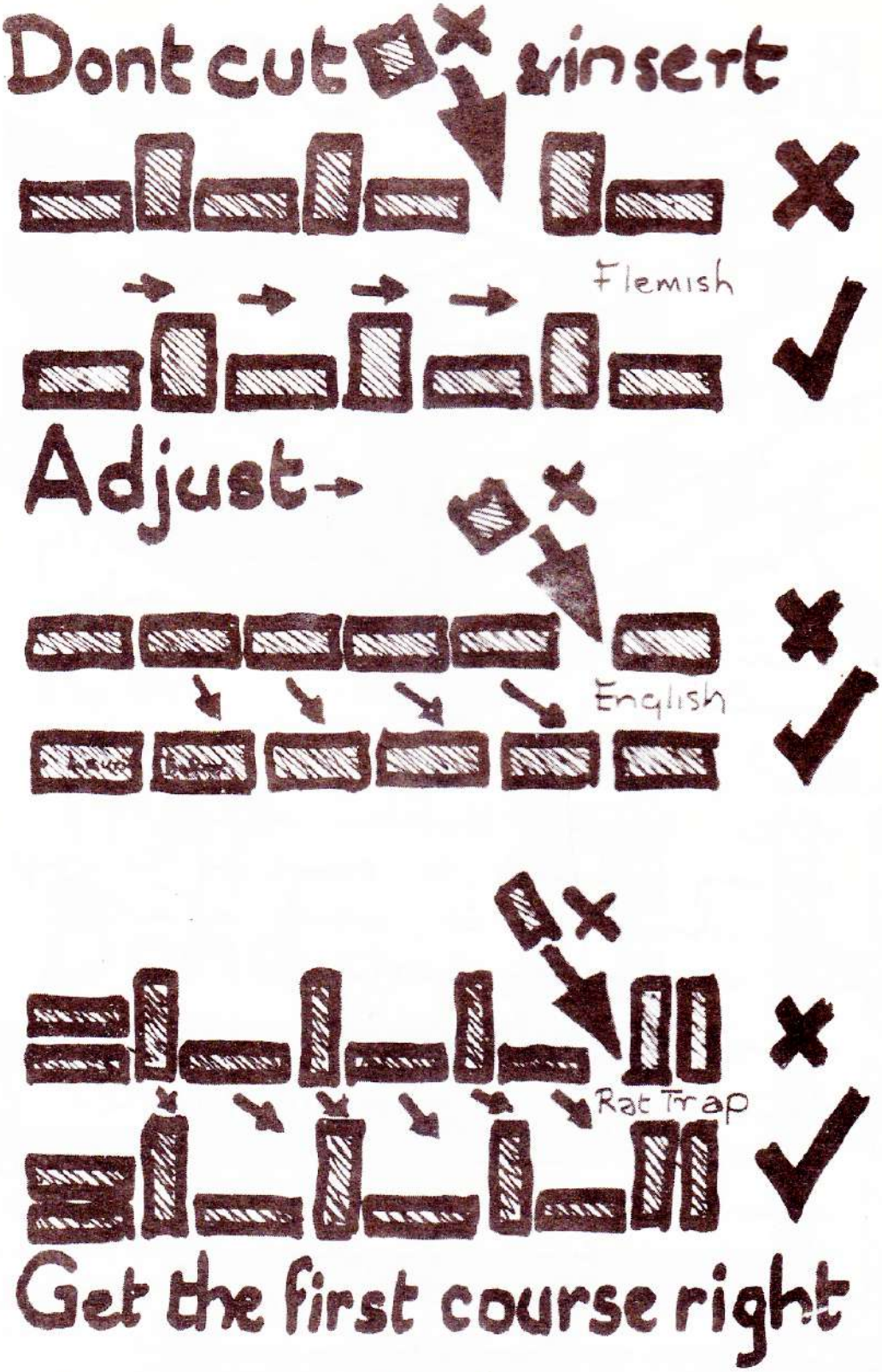
IS strong & Save's 25% of bricks & mortar

BRICKWORK

In many parts of India still the common most building material is burnt brick.
It is extremely versatile and if used properly & economically it gives one of the best safe strong beautiful walls in the world.

The following Pages show some of the lesser known ways of using brick & some of the ways in which it is very effective in reducing costs.

If the building is well designed there is no reason to plaster brick work. This alone saves about 10% of the total cost of the building. Furthermore no maintenance of exposed brick-work is required — another great recurring expenditure avoided



Teach your Contractors & mason's not to be wasteful in there work

Lay the mortar to cover the bricks,

and then lay the bricks carefully in position

Finally press the bulging mortar in firmly to be level with the face of the wall

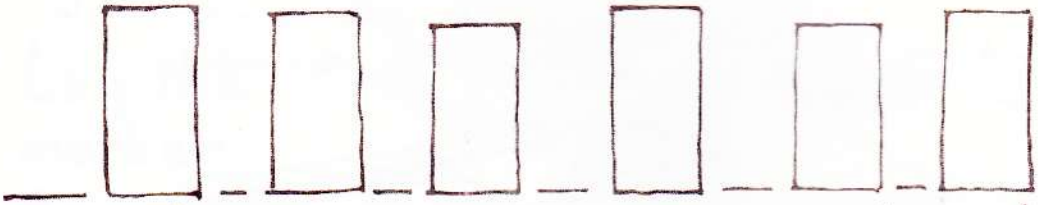
NO FURTHER POINTING IS NECESSARY

Pointing (meaning an extra process using special mortar) is unnecessary & costly.

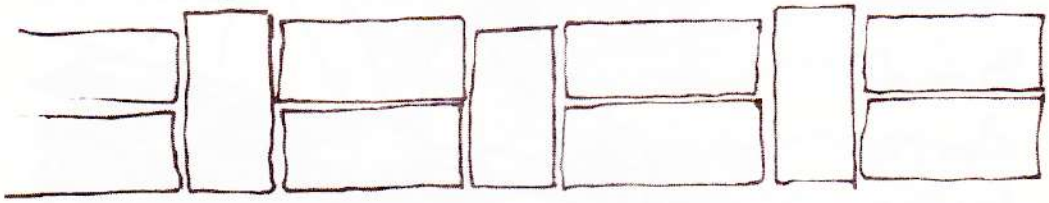
Using the Rat trap bond will save 20 to 25% on the cost of your brickwork.

Rat Trap Bond Mortar laying

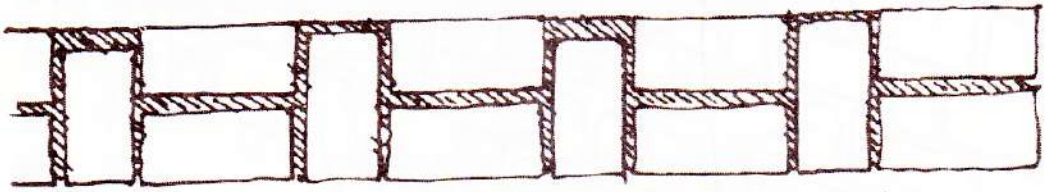
If mortar is placed careleesly on the bricks some of it will fall into the cavities & be wasted. This can be avoided by holding a piece of wood about 3 ft x 3 ins x 3/4" over the middle of the wall to cover the cavities while applying the mortar.



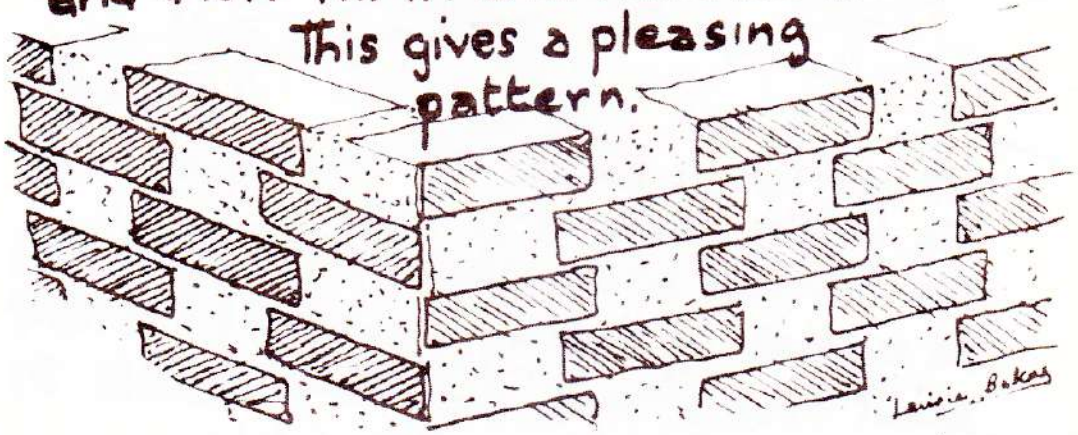
Bricks all vary slightly in length so only one side of the wall can be level.



To get a "fair face" on both sides you must bring the second row of "stretchers" forward and "in line",

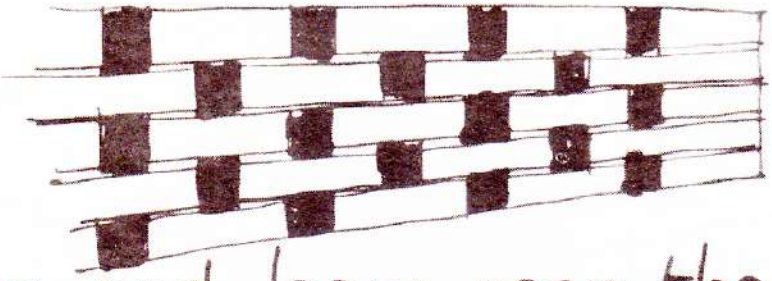


and then fill in the hollows with mortar

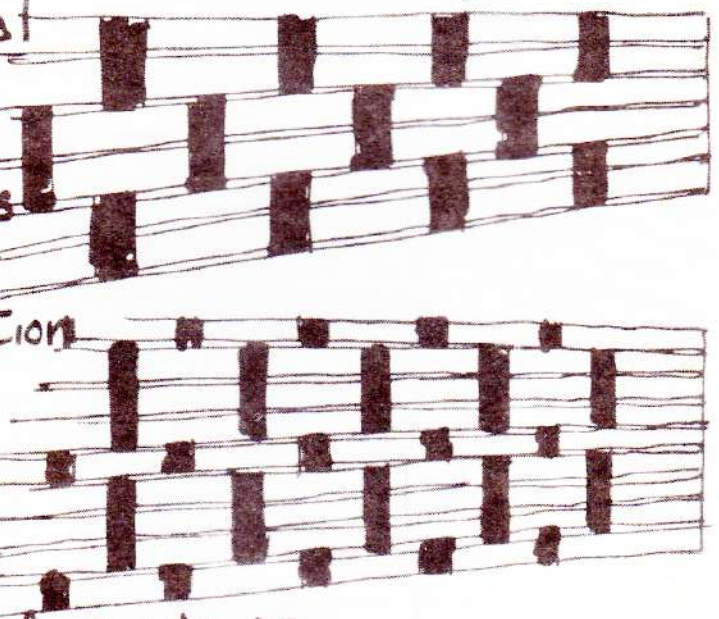


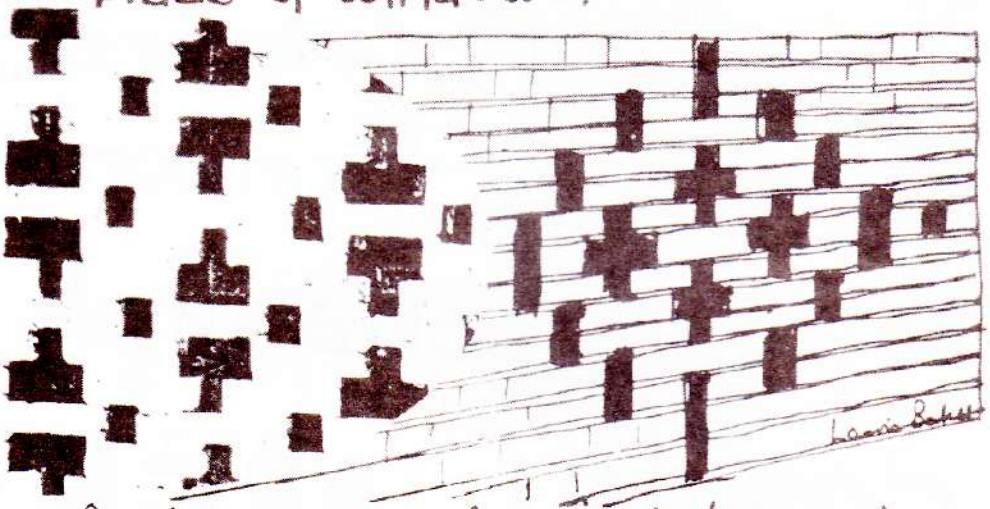
red Bricks does not mean that you

BRICK JALI

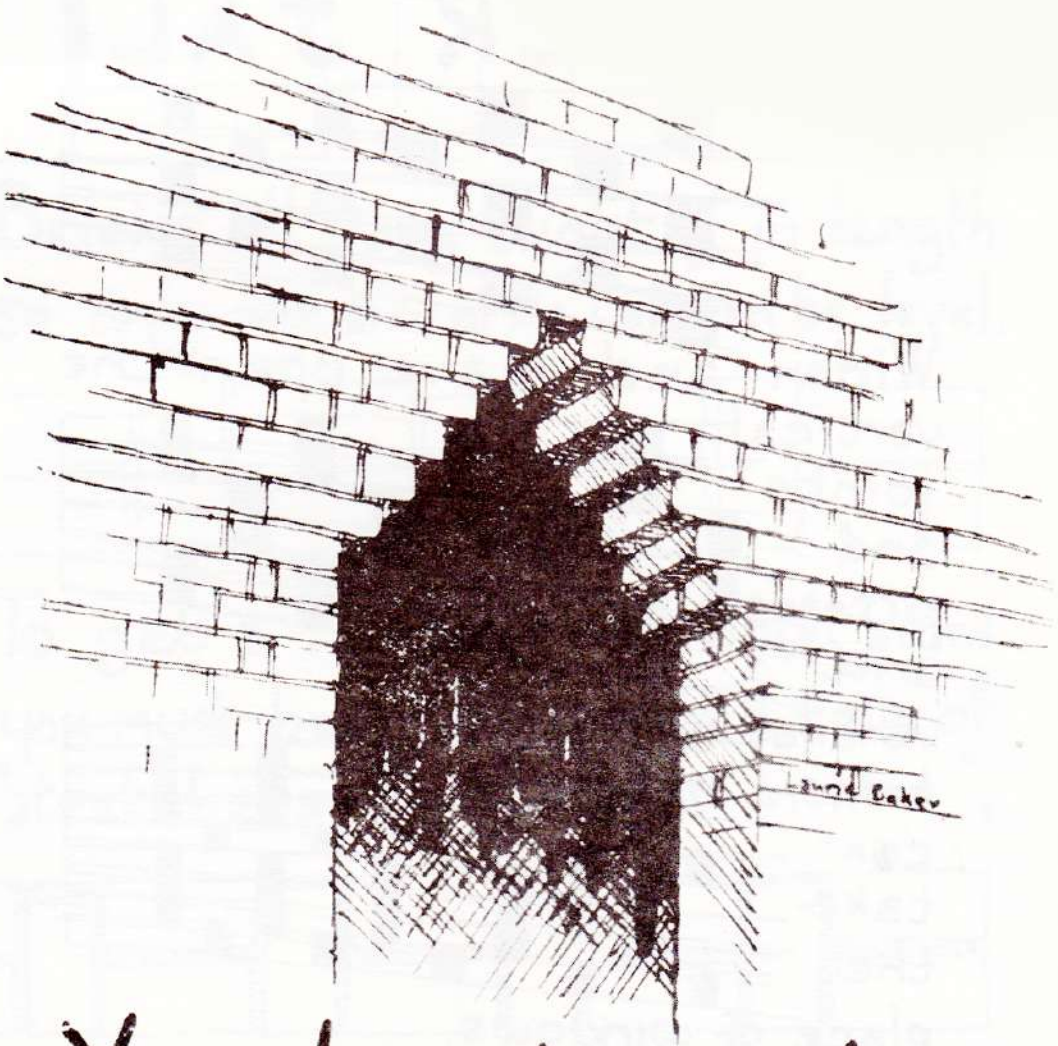


Widen and leave open the vertical joints and patterns and ventilation holes can take the place of windows.





Windows are costly & get damaged.
Jalis are much less costly & give good light & air



You do not require staging or formwork to construct a simple

CORBEL ARCH

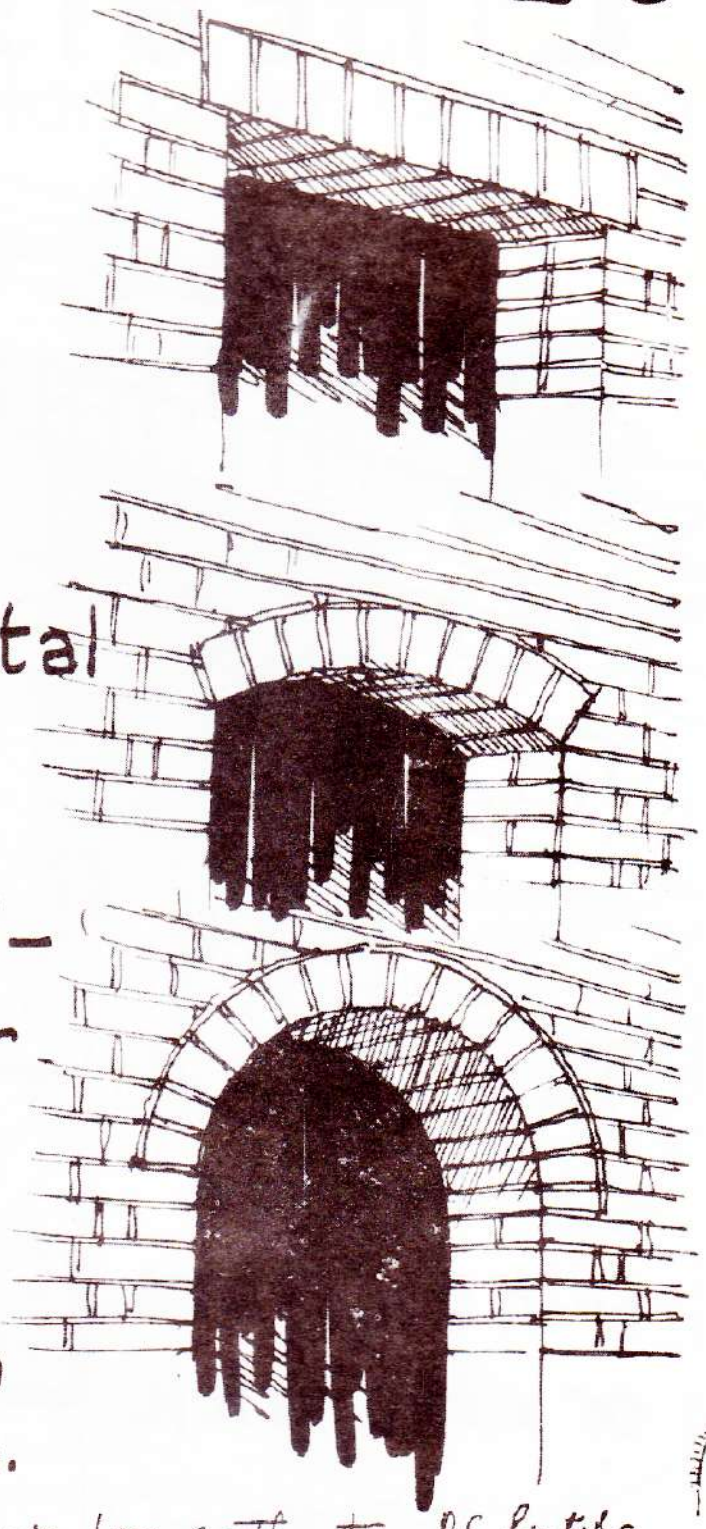
ARCHES

can be flat

or segmental

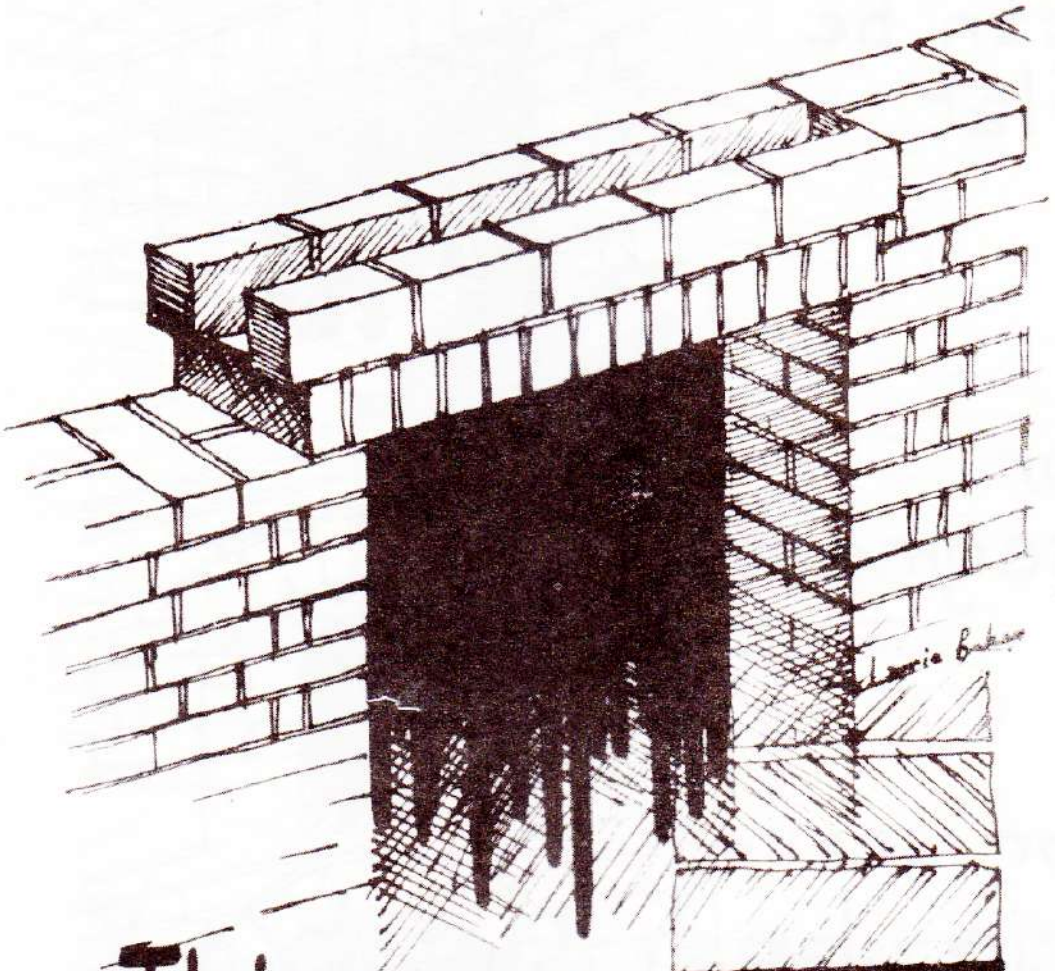
or semi-circular

or even pointed.



Arches are much less costly than RC lintels And ~~[illegible]~~ look far more elegant.

Lintels

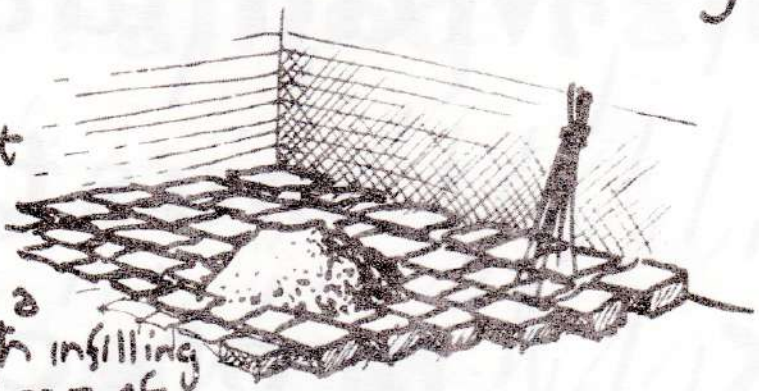


This space can be filled with concrete or with a brick

If a lintel is really necessary this is a less costly way of doing it

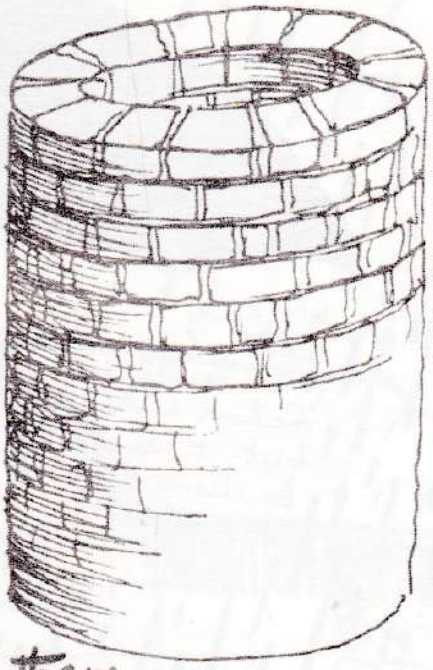
BRICK BATS

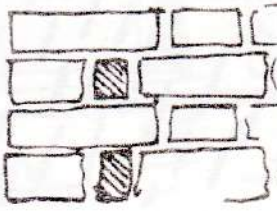
Use them for under-flooring



Lay them dry without mortar in rows tight together on a rammed earth infilling
Then mix a heap of lime mortar and brush it all over the floor
This gives a good base for all types of flooring

They are very useful for all sorts of curved or round walls such as for gate posts, spiral staircases etc. If a string of vertical joints is avoided such walls are very strong





and of course you always need them for orthodox bonding

Mud walls must be protected from water

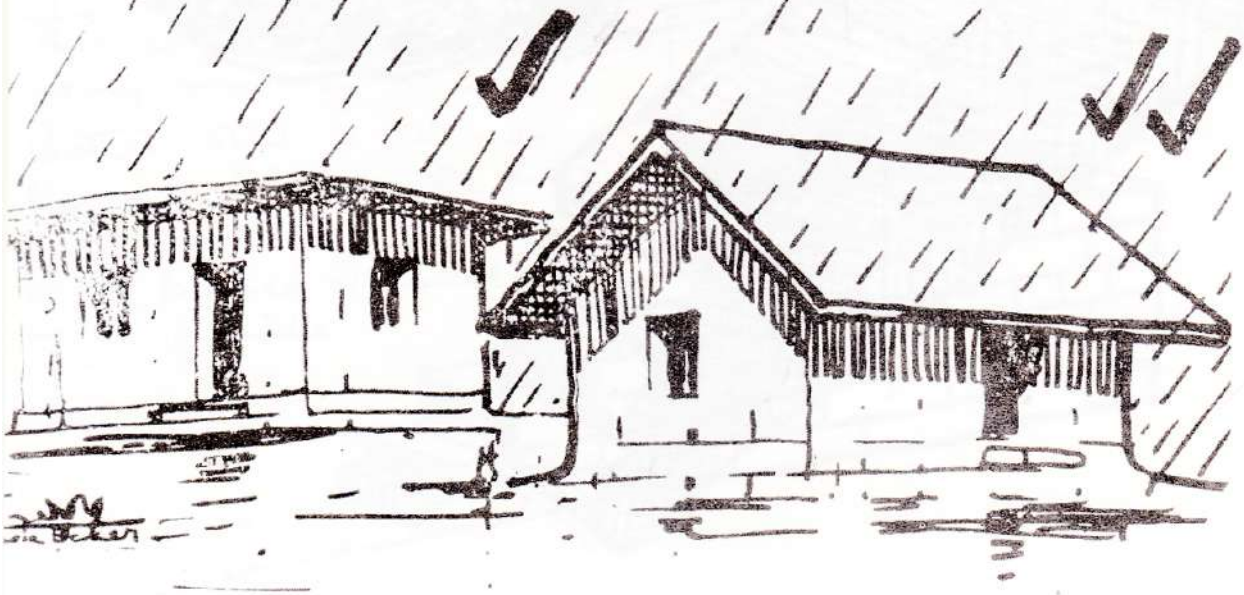
MUD

We can certainly use mud for School buildings but it must be done properly.

Many mud Buildings in India are over 100 years old.

protection from falling rain

The roof MUST overhang

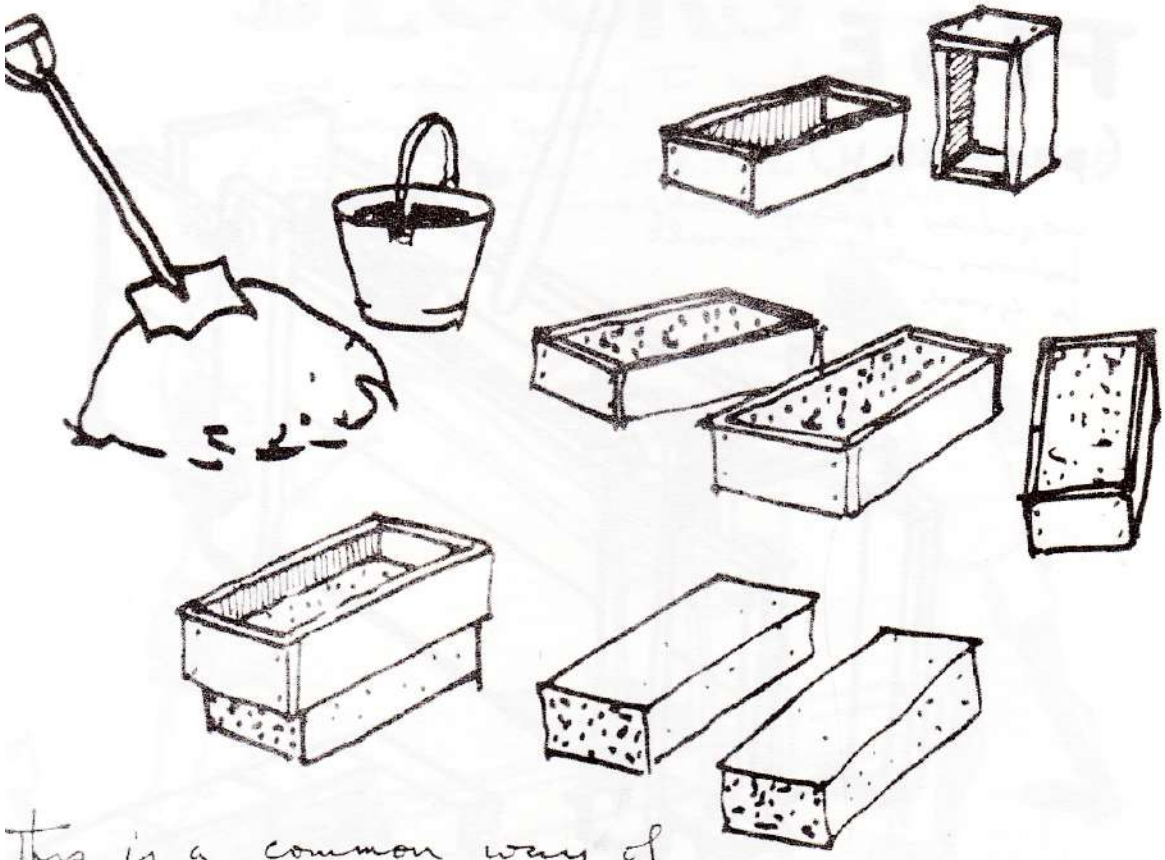


COB

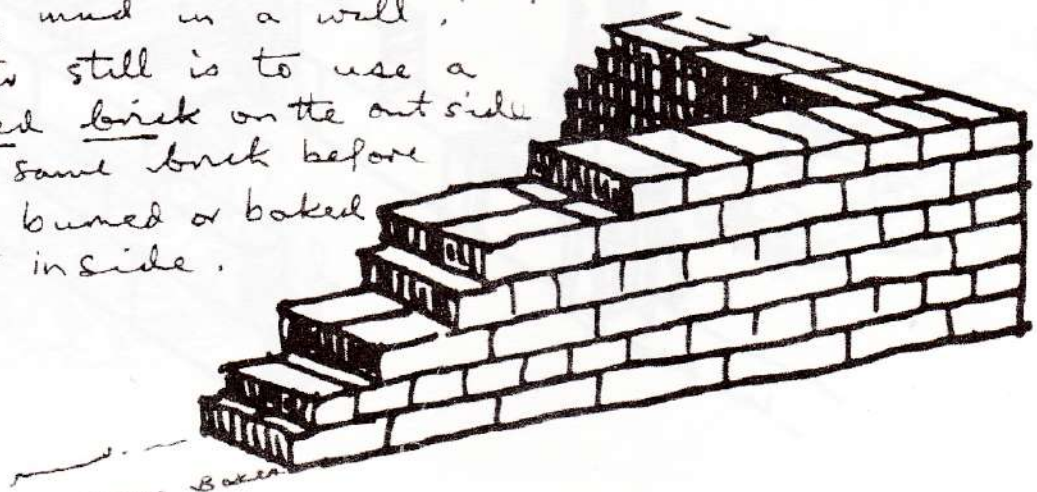
IS the simplest form of mud wall construction. Children & Parents can take part in the mud wall building with a little guidance.

ADOBE (a-doe-bee)

or SUN-DRIED BRICK



This is a common way of using mud in a wall. Better still is to use a burned brick on the outside & the same brick before it is burned or baked on the inside.



— LAURIE BAKER

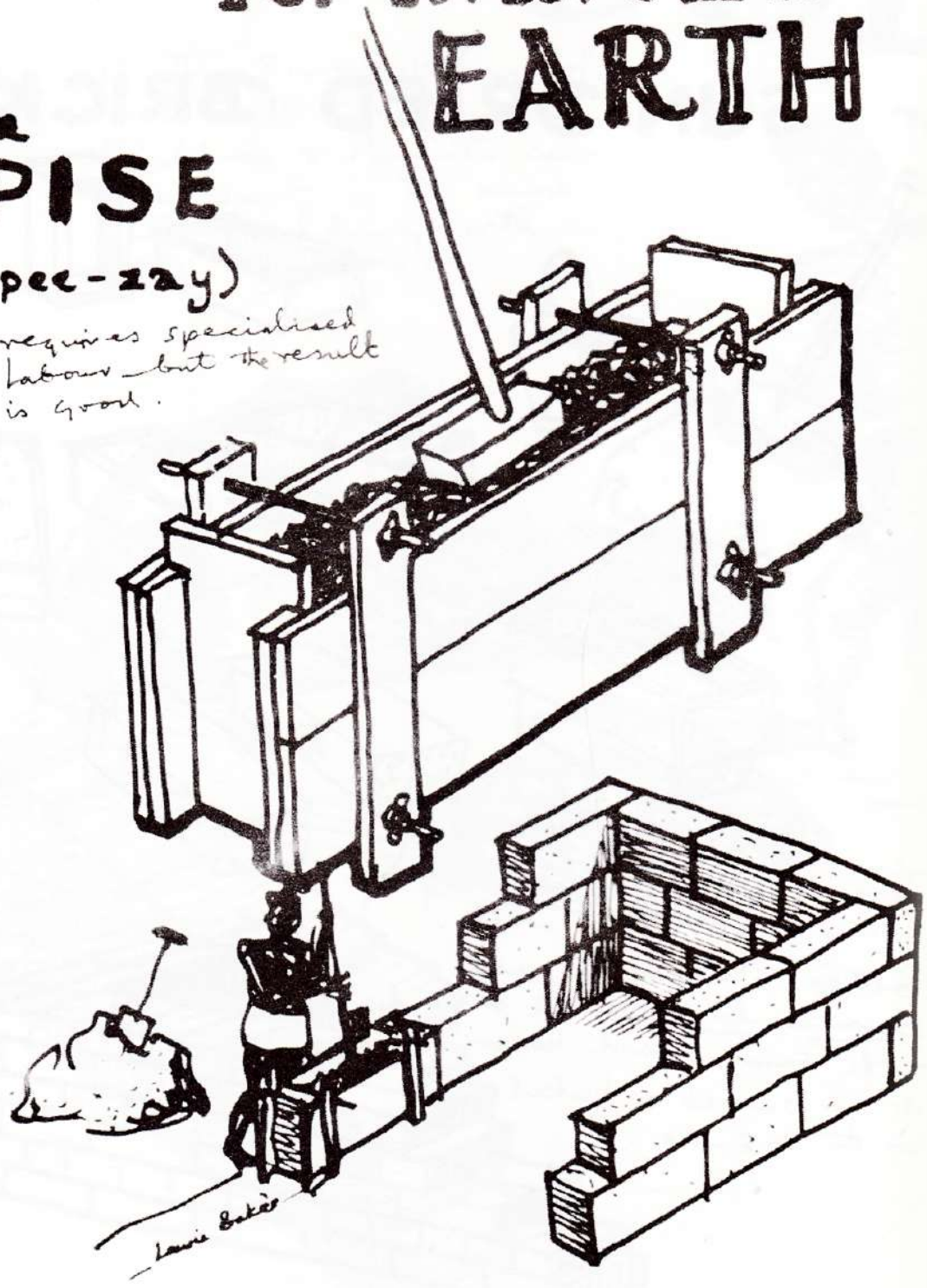
RAMMED EARTH

OR

PISE

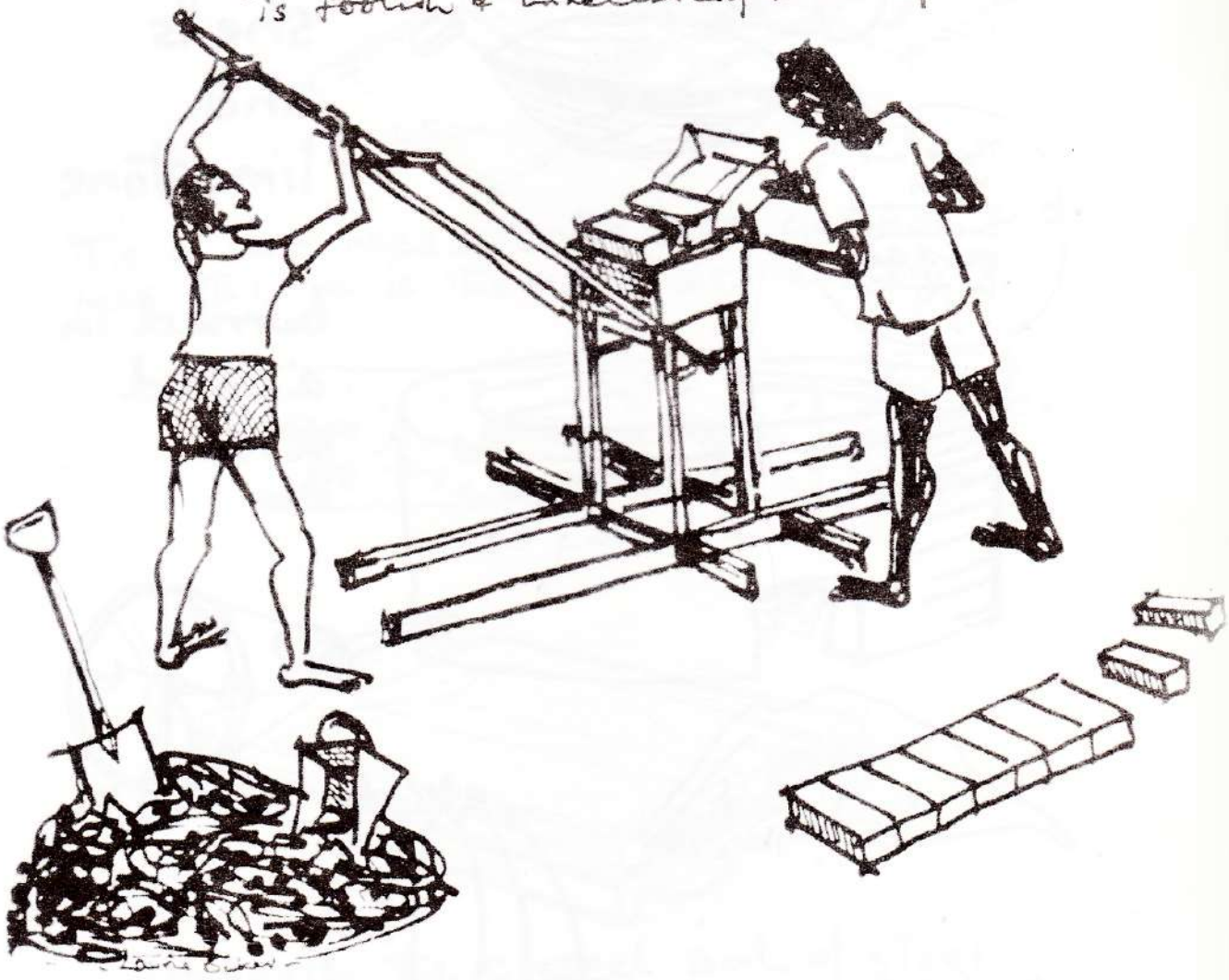
(pee-zay)

requires specialised labour but the result is good.

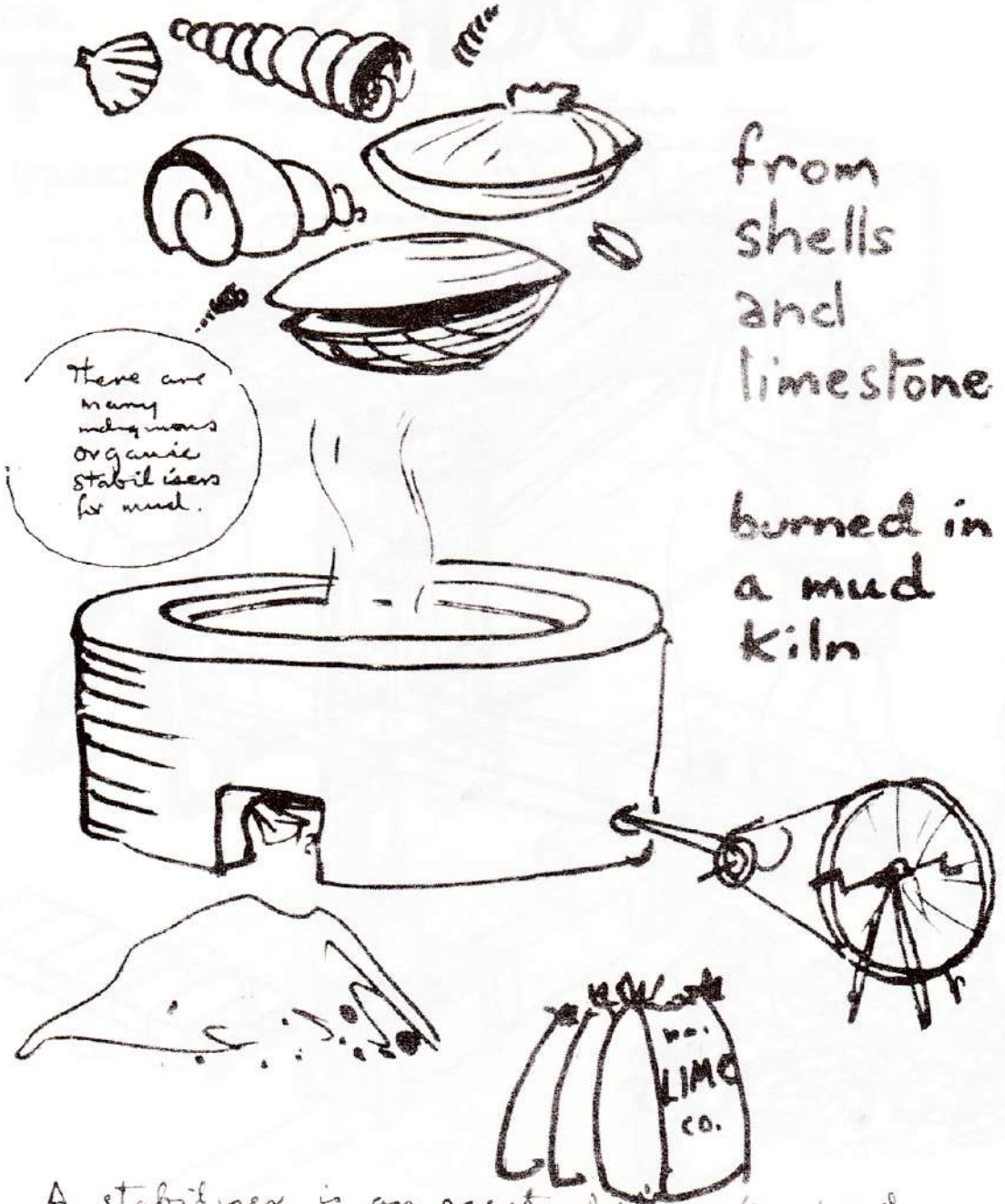


PRESSED EARTH BLOCKS

are now easy to make
& create good walls.
(but the "official" stabiliser of 5% Cement
is foolish & unnecessary & costly.



LIME probably the best and most used stabiliser



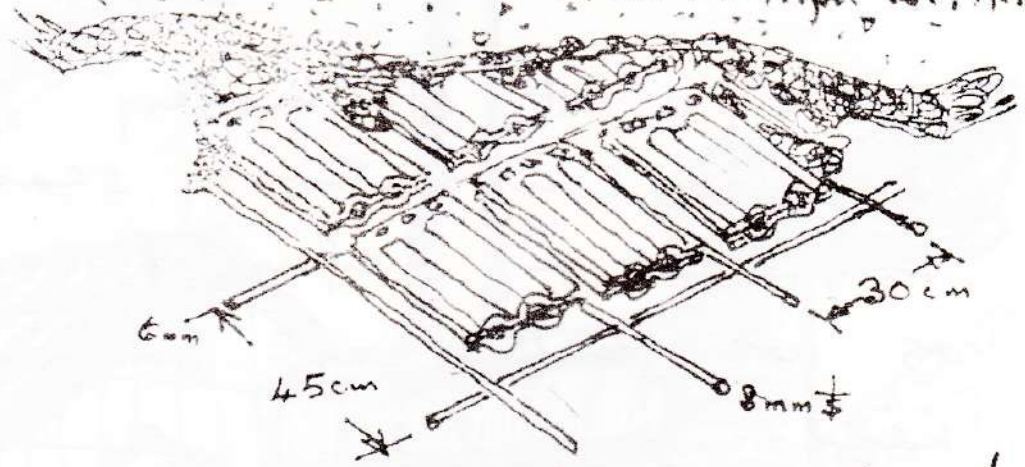
from shells and limestone

burned in a mud kiln

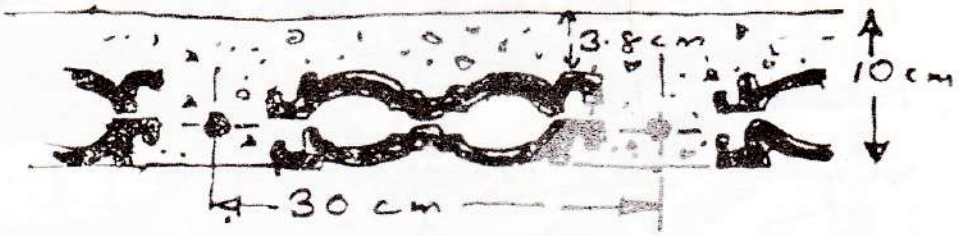
A stabiliser is an agent which makes mud stronger. Cement is energy intensive — Lime is better.

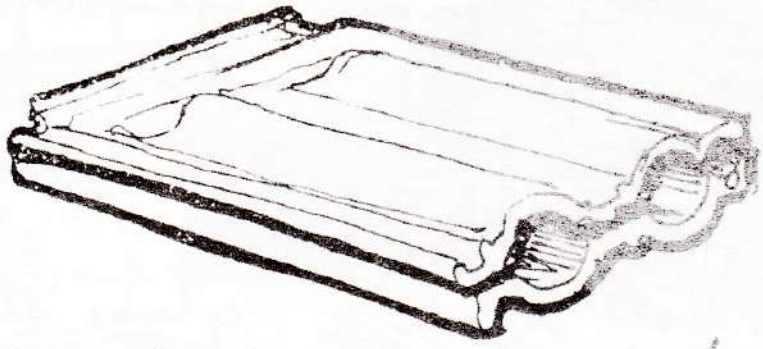
A FILLER SLAB

is a reinforced concrete slab but a 'filler' — any light weight objects — in this case old Mangalore tiles — replaces redundant concrete & creates a light wt. slab



this in turn necessitates less cement and less steel & is therefore less costly.





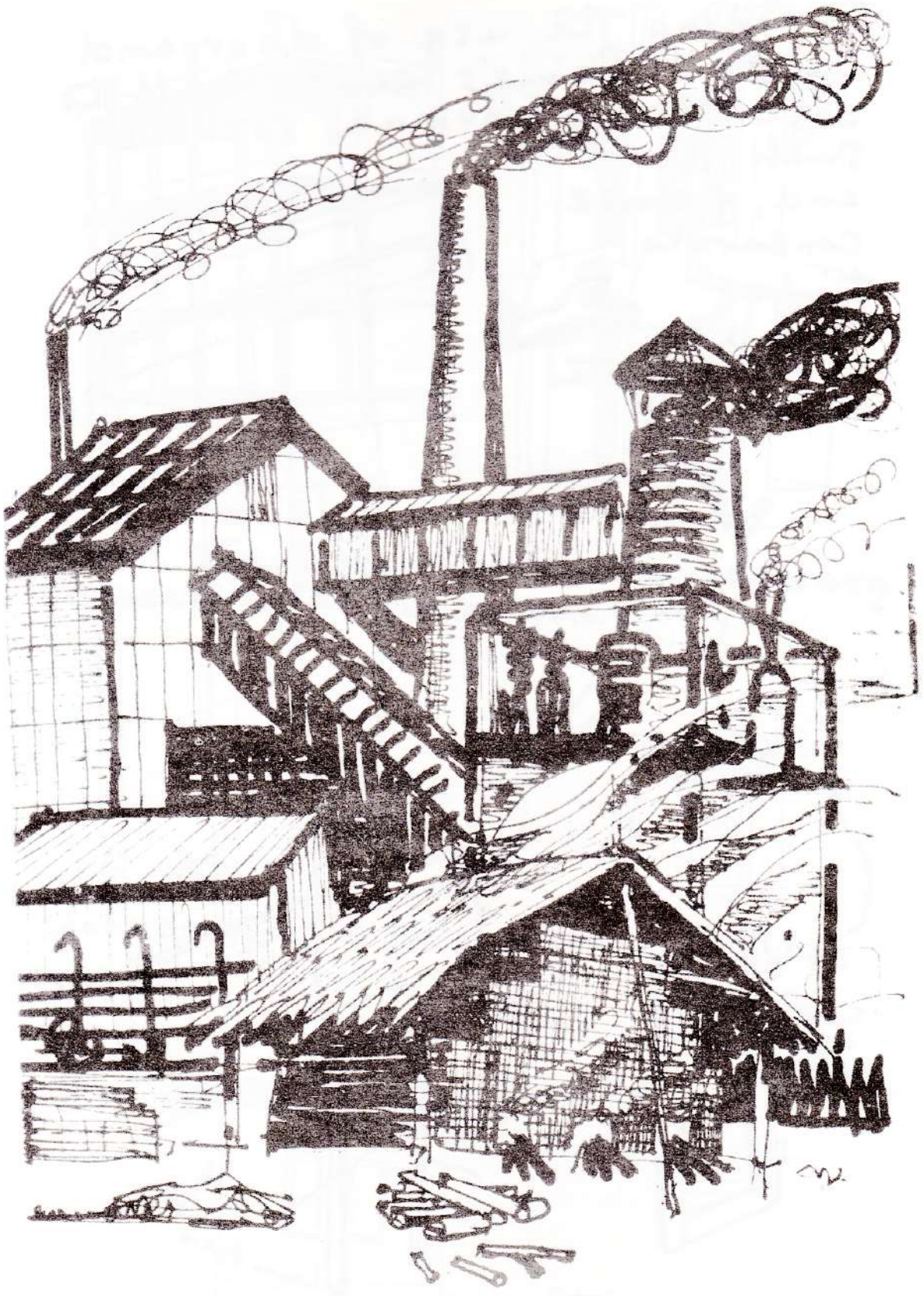
Obviously the correct amt. of steel has to be calculated as in any other form of reinforced concrete work.

ENERGY
or FUEL

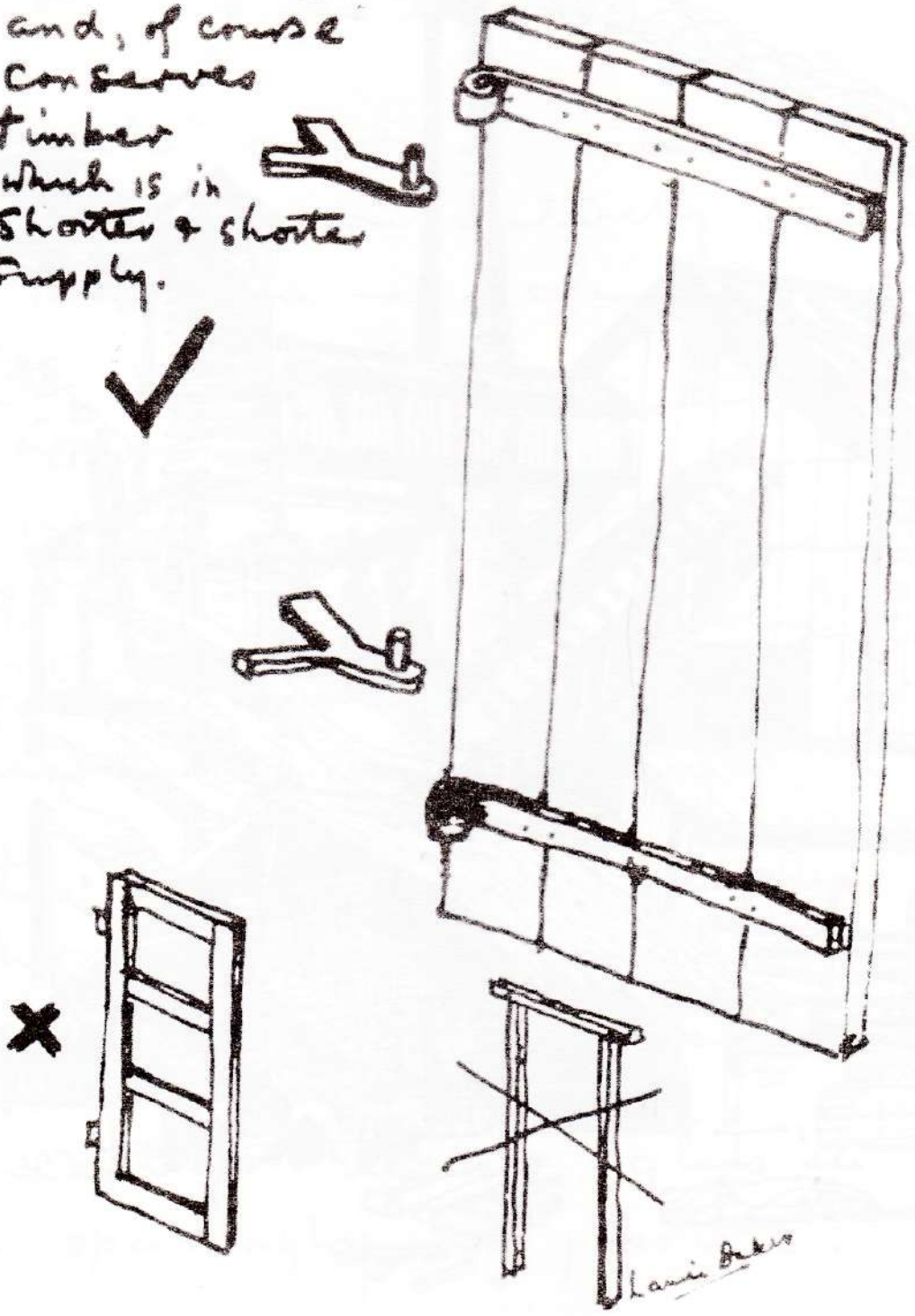
Costs a lot of money and is comparatively scarce in India — definitely it is not sufficient for our needs.

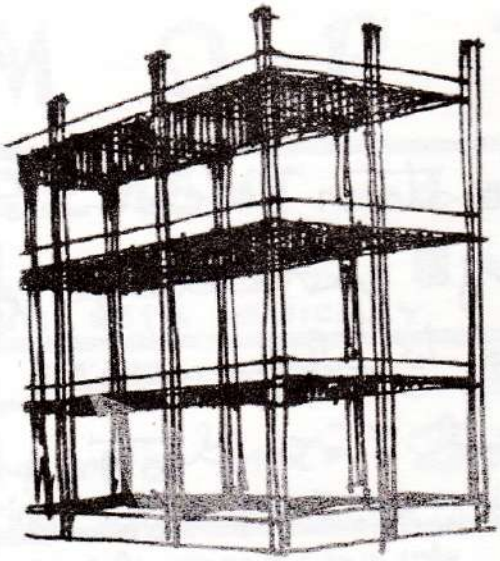
Whether our Schools are to be built with Public or Private money — we have no right to waste energy.

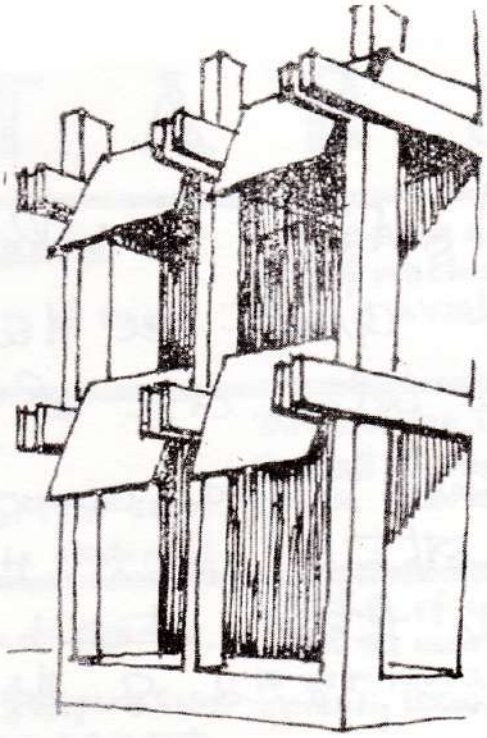
This is the main reason why we should continue to use materials like mud & stone, and use cement & steel & glass etc as sparingly as possible.



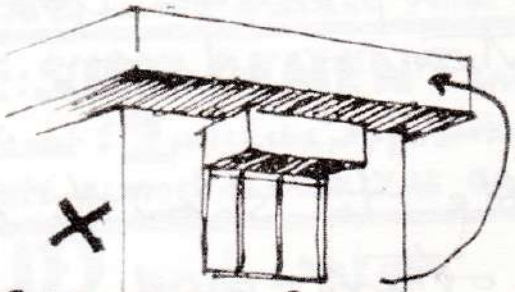
Avoiding the use of door and window frames saves half the cost that is normally spent on such items.
and, of course conserves timber which is in shorter & shorter supply.

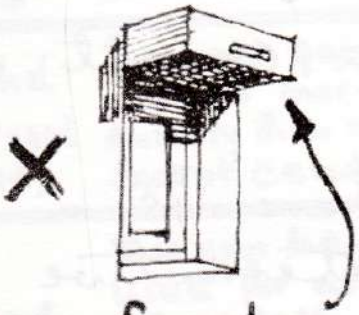




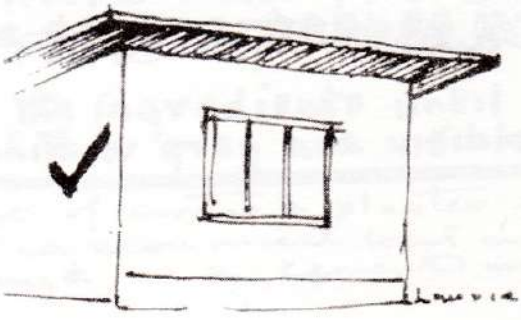


Much money is wasted on R.C.C. frame structures that are unnecessary (especially the fancy ones)





Unnecessary frills and fancy finishes use up a lot of money



Hassia Baker

Mortars & Plasters account for quite a large percentage of the total cost of a building. There is a current trend to use nothing but cement & Sand for these items. In many districts Lime and Surkhi are available. Lime is slow in setting but its ultimate strength in a mortar or plaster is every bit as good as a cement mortar or plaster.

Here is a table to show the content of alternative mortars and in most rural areas where any form of lime or calcium is available these mixes reduce the cost considerably.

MORTARS

A. **CEMENT and sand**
1 part of Cement : 8 parts of sand.
THIS SETS QUICKLY
Use cement only if nothing else is available.

B. **LIME and sand.**
1 part of Lime : 3 parts of sand.
THIS SETS SLOWLY but is strong.
This can be used for all types of brick work.

C. **LIME·CEMENT and sand.**
1 part Cement : 4 parts lime : 14 parts sand.
THIS SETS NEARLY AS QUICKLY AS CEMENT.
Use this if you need the mortar to set more quickly than lime

D. **LIME·SURKI and sand**
1 part Lime : 2 parts Surki : 6 parts sand
THIS SETS MORE QUICKLY THAN LIME
This is slightly stronger than pure lime and sets more quickly

E. **LIME·SURKI·CEMENT and sand**
1 part Cement : 2 parts Lime : 4 parts Surki : 20 sand
THIS SETS ALMOST AS QUICKLY AS CEMENT.
This gets good results more quickly than all except cement.

F. **MUD and water**
Use the same mud, sifted, as used for mud blocks with enough water to make it plastic & usable.
This can be used for all 9" walls if protected.

ALWAYS MIX THE DRY INGREDIENTS TOGETHER BEFORE ADDING THE WATER

Mix the ingredients until no patches or streaks of white or grey are visible. Then add the water.

A lot of mortar & plaster goes into a building. Use an economical local mortar. It is the same strength as a cement mortar that is costly & energy ful

These preceeding pages are to show just a few ways of reducing costs for primary school buildings

1 Have an efficient plan without wasting space or materials, and make available plans which can be adapted to different areas using different materials

2 Use simple, sensible, well-tried, locally available materials which local craftsmen know how to use. Performance can be improved with guidance & training.

3 Avoid as much as possible the use of energy intensive materials

4 Of every component part of a building, including the plan, the layout, the materials, the techniques & the labour, always ask "Is it necessary?" If it is not — then don't do it. You are wasting money, energy & materials.
Even if it is necessary make sure you are using it efficiently to suit the locality with its climate & materials

5 A lot of little economies & leaving out unnecessary items will quickly all add up to a considerable saving of overall cost.

6 All of this must never be at the cost of reducing structural stability.

7 Do not reject or despise traditional materials & systems unless they have become useless.

COSTFORD

The Centre of Science and Technology for Rural Development known by its acronym COSTFORD was established in 1985 to develop, demonstrate and disseminate alternative technologies that will ultimately change the social, economic and political positions of the poor, deprived and marginalized sections of society. The initial thrust area of the activities of COSTFORD was the diffusion of cost and energy effective alternatives to building technology. In consideration of the commendable work done by COSTFORD, the Government of Kerala has recognized it as an accredited agency to execute construction works using alternative technologies for all Government Departments and Agencies. Hundreds of architects and engineers trained by COSTFORD in Baker philosophy have become the change agents in the construction sector. It also gives special emphasis to the needs of women in society through training, organization and employment generation schemes.

COSTFORD extends consultancy services to Panchayati Raj Institutes for local economic development, decentralized planning and governance.

Besides, COSTFORD has also been interacting with students from various disciplines and has created a library and research centre on subjects that are relevant from the point of people-centred development. Annual memorial lectures by eminent public personalities and intellectuals are organised to commemorate the contributions of C. Achutha Menon, K.N. Raj and Laurie Baker. Special lectures and classes are also conducted on themes of topical interest.

COSTFORD has constructed a large number of buildings including houses for government and non-government institutions and families. In its quest to carry on the legacy of Laurie Baker, it has also been experimenting with alternative cost effective but environmentally-friendly materials such as bamboo, mud and wood. It has won several prizes and awards for its construction activities. More details can be accessed from its website: www.costford.org

COSTFORD has published 12 books authored by Laurie Baker and 30 books authored by others. A Malayalam quarterly "Puthuvazhi" is being published under its initiative to promote and popularize alternative perspectives on development, environment, gender, social oppression and culture.

LBC for Habitat Studies

The Laurie Baker Centre for Habitat Studies was established in 2009 to carry on the legacy of Laurie Baker. Located 12 kms from Trivandrum city in a lush campus of around 4 acres in the Vilappilsala Panchayat, it conducts training, research and publication activities. More details can be accessed from its website: www.lauriebakercentre.org

COSTFORD

Registered Office
Ayyanthole, Thrissur, Kerala - 680 003
costfordayyanthole@gmail.com
+91 487 2365 988, 2366 388; Fax: +91 487 2366 388

COSTFORD Sub Centres

Thiruvananthapuram	'The Hamlet', Nalanchira P.O, Thiruvananthapuram - 695 015 costfordtvm@gmail.com +91 471 2530 031, +91 94465 57820
Kollam	TD. Nagar-103, High School Junction, Kachery P.O., Kollam – 691 013 costfordkollam@gmail.com +91 474 2796 493, +91 94957 00298
Alap zha	'Laxmi', Mullackal P.O, Alappuzha – 688 010 costfordalpy@yahoo.com +91 93498 37016
Kochi	House No. 44/965, Pavakulam Lane, Near Post Office, Kaloor, Kochi -682 017 costfordekm@gmail.com +91 94470 46849
Thrissur	Thrissur District Centre, Ayyanthole, Thrissur - 680 003 +91 487 2365 988, +91 94463 24369
Triprayar	Sree Rama Polytechnic, Valapad P.O, Thrissur - 680 567 costfordtpr@gmail.com +91 94473 91526
Shornur	Gurunilayalam, Opp. Suma Theatre, Shornur – 679 121 nanducostford@gmail.com +91 94477 33853
Palakkad	"Lakshana", Puthur, Palakkad -678 001 +91 94478 39161
Ponnani	Near Thrikkavu Temple, P.O. Ponnani, Malappuram -679 577 +91 94475 27349
Malappuram	"Govindam", Dr. Shaju Road, MSPLP School, Malappuram - costfordmpm2010@gmail.com +91 94477 78356
Kozhikode	Puthenpurayil , Edakkadu P.O, Kozhikode - ragamcafe123@gmail.com +91 97475 02284

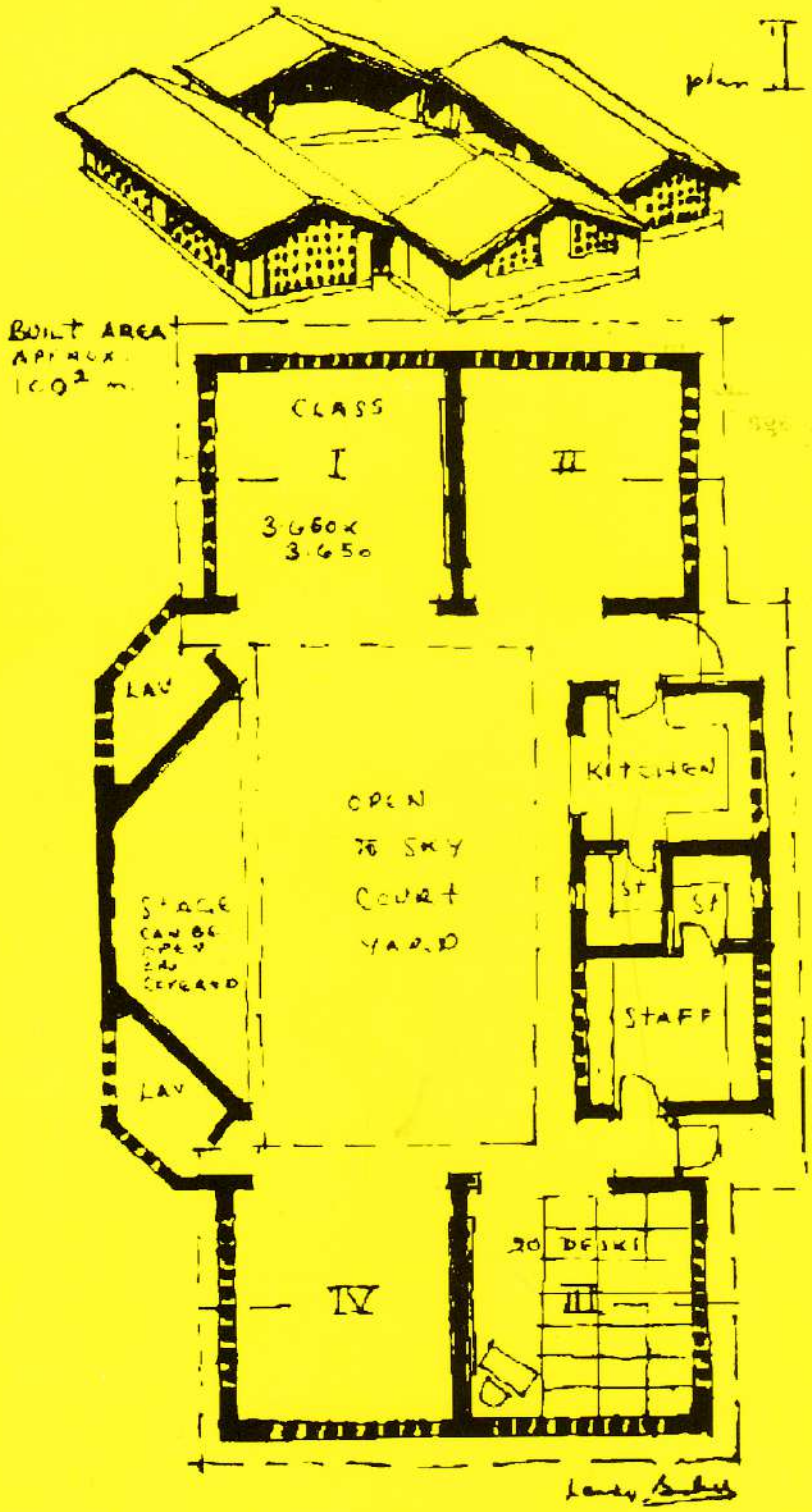
THE AUTHOR

Laurence Wilfred Baker was not just a well-known architect. He was also a cartoonist, a man who loved nature and above all, a humanist. He was a Gandhian in his thoughts and deeds. Born in 1917 he became an Associate of the Royal Institute of Architects in the United Kingdom after studying at the Birmingham School of Architecture. A chance meeting with Mahatma Gandhi inspired and introduced him into India in 1944. Following this he lived and worked in India helping his Kerala-born wife and medical doctor Elizabeth Baker and also practicing his architecture in meeting the housing and living requirements of the rural poor. It was in a remote village, Pithoragarh, in the Himalayan region where they built their home, hospital and school. In the mid-sixties the Bakers moved to Kerala and made it their home.

After moving to the city of Trivandrum in 1970, Baker built several buildings including numerous houses and institutions that were cost effective as well as environment-friendly. The late C. Achutha Menon, the visionary Chief Minister of Kerala during 1969-77 was an admirer and ardent supporter of Baker's philosophy and approach to building construction. So was the late K.N. Raj, one of India's outstanding economists. Baker was closely associated with several governmental and other public institutions to advise on matters relating to cost effective building technology. He also mentored a large number of young architects who came to work and live in Trivandrum. He authored several books imparting knowledge on housing and building construction. He also drew cartoons and was also a painter. He and his wife led a life of simplicity and service. Laurie Baker passed away on 1st April 2007.

There are two organizations that carry on his legacy. One is the Centre of Science and Technology for Rural Development known as COSTFORD headquartered in Thrissur with units in Trivandrum and other districts in Kerala. This was jointly founded by C. Achutha Menon, K.N. Raj and Laurie Baker himself in 1985. The other is the Laurie Baker Centre for Habitat Studies located in Trivandrum and founded in 2009 under the initiative of COSTFORD activists with financial support from the Government of Kerala to undertake training, research, publication and other activities relating to the building of a green habitat following the philosophy and approach of Laurie Baker.

Laurie Baker Series: Book - 8



COSTFORD

Centre of Science and Technology For Rural Development